Scientific and Technical Aerospace Reports

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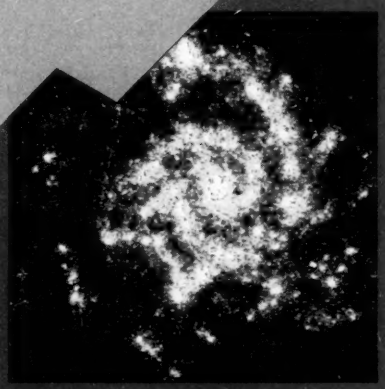

An Abstract Journal

NASA STI PROGRAM SCIENTIFIC & TECHNICAL INFORMATION

Volume 30, Number 11
June 8, 1992
N92-20046 to N92-21070

Scientific and Technical Aerospace Reports

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N.A.—no abstracts were assigned to this category for this issue.

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SPACE SCIENCES For related information see also *Geosciences.*

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Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

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93 SPACE RADIATION **1913**
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Includes aeronautical, astronautical, and space science related histories, biographies, and pertinent reports too broad for categorization; histories or broad overviews of NASA programs.

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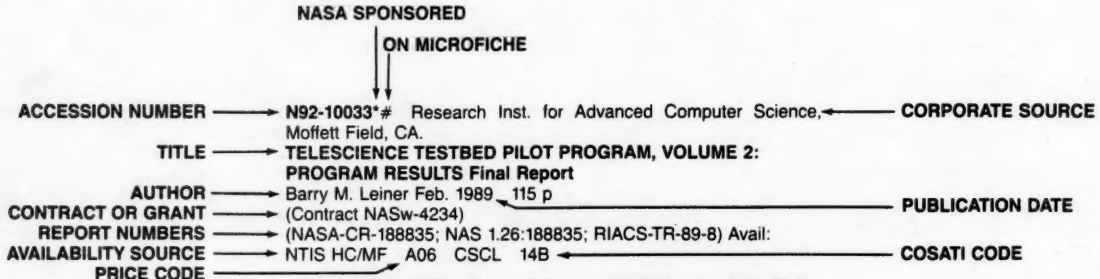
TYPICAL CITATION AND ABSTRACT



Space Station Freedom and its associated labs, coupled with the availability of new computing and communications technologies, have the potential for significantly enhancing scientific research. A Telescience Testbed Pilot Program (TTPP), aimed at developing the experience base to deal with issues in the design of the future information system of the Space Station era. The testbeds represented four scientific disciplines (astronomy and astrophysics, earth sciences, life sciences, and microgravity sciences) and studied issues in payload design, operation, and data analysis. This volume, of a 3 volume set, which all contain the results of the TTPP, contains the integrated results. Background is provided of the program and highlights of the program results. The various testbed experiments and the programmatic approach is summarized. The results are summarized on a discipline by discipline basis, highlighting the lessons learned for each discipline. Then the results are integrated across each discipline, summarizing the lessons learned overall.

Author

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Scientific and Technical Aerospace Reports

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01 AERONAUTICS (GENERAL)

N92-20204# National Research Council of Canada, Ottawa (Ontario). Inst. for Aerospace Research.
[ACTIVITIES OF NRC-CNRC, INSTITUTE FOR AEROSPACE RESEARCH] Annual Report, 1990 - 1991 [NRC-CNRC INST. DE RECHERCHE AEROSPATIALE, RAPPORT ANNUEL 1990-1991]
1991 30 p In ENGLISH and FRENCH Original contains color illustrations
(CTN-92-60431) Avail: NTIS HC/MF A03

This report presents a summary of the research projects of the Institute of Aerospace Research (IAR) of the National Research Council of Canada during the fiscal year 1990-1991. The mission of the IAR is to undertake, assist and/or promote research and development in support of the Canadian aerospace community in matters affecting the design, manufacture, performance, use, and safety of aerospace vehicles. IAR facilities include the Applied Aerodynamics Laboratory, the High Speed Aerodynamics Laboratory, the Flight Research Laboratory, and the Structures and Materials Laboratory. During the reporting year, the level of interactions with clients and collaborators has increased steadily. IAR wind tunnels, in particular, attracted a high level of business. Of particular significance was involvement with the Department of National Defence (DND) in the Follow-On Structural Test Program for the CF-18; a collaborative undertaking with CAE Electronics Ltd supporting development of a Dash 8 flight simulator; expanded collaboration with Boeing Canada, deHavilland Division; the acquisition of a Falcon 20 research aircraft; successful negotiations of a follow-on phase of aircraft dynamics research related to high manoeuvrability with DND and the U.S. Air Force; and occupancy of expanded facilities for aircraft structures research.
Author (CISTI)

N92-20205# National Research Council of Canada, Ottawa (Ontario). Flight Research Lab.
[ACTIVITIES OF NRC-CNRC, INSTITUTE FOR AEROSPACE RESEARCH, FLIGHT RESEARCH LAB.] Annual Progress Report, Fiscal Year 1990 - 1991
Oct. 1991 173 p
(CTN-92-60432) Avail: NTIS HC/MF A08

This report presents a summary of the research projects of the Flight Research Laboratory (FRL) of the National Research Council of Canada during the fiscal year 1990-1991 and a brief indication of future plans for continuing and new projects. Collaborative projects have been undertaken with universities, industry, Canadian government agencies, and international organizations. Names of collaborating organizations are provided for each project. The FRL research fleet facilities include: (1) a fully instrumented DHC-6 Twin Otter atmospheric research aircraft; (2) a Bell 205A airborne simulator which supports inflight investigations of control and cockpit systems, and database generation for aircraft specifications; (3) a Convair 580 research aircraft which is used as a multipurpose flying laboratory; (4) a T-33 flight research aircraft which is used for microgravity research, flight mechanics research, in-flight turbulence and static pressure measurement; and (5) a Falcon 20 research aircraft which joined the fleet this year was acquired as a multipurpose research platform for research on microgravity, avionics, sensors, microwave landing systems, and airborne atmospheric phenomena. Ground facilities include: the Flight Recorder Playback Center, a facility for analysis of recorded information particularly in accident and incident investigations and the Flight Research Laboratory Speech Research Centre which is involved in the development of voice I/O technology and which also supports aircraft accident investigations.
CISTI

02 AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

For related information see also *34 Fluid Mechanics and Heat Transfer.*

N92-20229# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
TEMPERATURE EFFECTS IN FFA HYP 500 AT M = 7 IN A FLOW WITH STRONG EXPANSION
Magnus Linde Jul. 1991 19 p
(FFA-TN-1991-27; ETN-92-91059) Avail: NTIS HC/MF A03

The flow in a cold hypersonic wind tunnel was investigated at Mach 7 with respect to effects of condensation in flow with expansions. For the tests the flow on the upper side of a delta wing at angle of attack was investigated with a pressure probe and with oil surface flow technique. The testing was made with different stagnation temperatures. It was found that no effects could be found on the forward part of the wing. On the rear part some influence of the stagnation temperature on the flow structure was found. This could be due to the effects of condensation. It is believed that the finite time constant for the condensation process gives a delay in the onset of condensation and that this was the case in the present tests. The limited tests do, however, not allow definite conclusions to be drawn.
ESA

N92-20283*# Complere, Inc., Palo Alto, CA.
MEASUREMENT OF VORTEX FLOW FIELDS Final Report
T. Kevin McDevitt, Todd A. Ambur, Gary M. Orngard, and F. Kevin Owen Jan. 1992 100 p
(Contract NAS1-18667)
(NASA-CR-189543; NAS 1.26:189543) Avail: NTIS HC/MF A05 CSCL 01A

A 3-D laser fluorescence anemometer (LFA) was designed, built, and demonstrated for use in the Langley 16 x 24 inch Water Tunnel. Innovative optical design flexibility combined with compact and portable data acquisition and control systems were incorporated into the instrument. This will allow its use by NASA in other test facilities. A versatile fiber optic system facilities normal and off-axis laser beam alignment, removes mirror losses and improves laser safety. This added optical flexibility will also enable simple adaptation for use in the adjacent jet facility. New proprietary concepts in transmitting color separation, light collection, and novel prism separation of the scattered light was also designed and built into the system. Off-axis beam traverse and alignment complexity led to the requirement for a specialized, programmable transverse controller, and the inclusion of an additional traverse for the off-axis arm. To meet this challenge, an 'in-house' prototype

unit was designed and built and traverse control software developed specifically for the water tunnel traverse applications. A specialized data acquisition interface was also required. This was designed and built for the LFA system. Author

N92-20332 Case Western Reserve Univ., Cleveland, OH.
AN INVISCID STABILITY ANALYSIS OF UNBOUNDED SUPERSONIC MIXING LAYER FLOWS Ph.D. Thesis
Fang-Pei Liang 1991 186 p
Avail: Univ. Microfilms Order No. DA9137033

An analysis is performed of the inviscid linear stability of unbounded supersonic mixing layer flows. The general stability characteristics of subsonic and supersonic solutions and the unstable eigen spectrum are discussed. The existence of neutral solutions supersonic to either or both free streams is verified. Two unstable supersonic modes, which can be supersonic to either or both of the free streams, are found and the transition from the supersonic modes to that associated with generalized inflection point is investigated. Systematical study is made of the unstable eigen spectrum using a number of numerical methods, including the method of the principle of argument and the method of multi-domain Chebyshev collocation with the QZ algorithm. The method of the principle of argument is robust and theoretically neat. The Chebyshev collocation method, however, is very expensive when applied to supersonic stability computation because of the presence of the critical point singularity and the slow damping of the eigenfunction at free streams. It is concluded that for unbounded flows there are only a small number of supersonic unstable modes (two modes in our cases) and the exact number for a given supersonic flow is generally not known. To determine the number of unstable modes requires detailed investigation by, e.g. the method of the principle of argument. Dissert. Abstr.

N92-20378 Purdue Univ., West Lafayette, IN.
AEROELASTIC BEHAVIOR OF AN ADAPTIVE LIFTING SURFACE Ph.D. Thesis
Steven Michael Ehlers 1991 187 p
Avail: Univ. Microfilms Order No. DA9201321

The use of an adaptive structure to control the static aeroelastic behavior of a lifting surface is examined. The wing structure is modeled as a laminated beam with bending and torsional deformation freedom. Actuation is provided by piezoelectric materials embedded in the wing structural laminate. The structure is made adaptive by using a feedback control system that applies a voltage to the piezoelectric material layers in direct proportion to the wing root loads. Lift effectiveness, static stability, and rolling behavior of the wing are controlled by varying the feedback gain. Both differential equation and discrete model approaches are used in the analysis. It is shown that the lift effectiveness of a wing can be increased or decreased with respect to its nonadaptive behavior by controlling the feedback gain. The adaptive structure may also be used to increase the divergence dynamic pressure of the wing. The adaptive structure approach is also used to alter the rolling power, damping in roll, and steady state roll effectiveness of a uniform wing by varying the feedback gain. It is shown that the adaptive structure may be used to increase or decrease the rolling power of a wing with a control surface. Damping in roll can also be actively controlled. Simultaneously controlling rolling power and roll damping can be used to modify the steady state roll rate. Dissert. Abstr.

N92-20468# Aeronautical Research Inst. of Sweden, Stockholm. Aerodynamics Dept.
MATGRID: A PROGRAM FOR GENERATION OF C-H AND C-O TOPOLOGY GRIDS AROUND WING/BODY CONFIGURATIONS. MATHEMATICAL DEFINITION DOCUMENT
Sven G. Hedman and Lars G. Tysell Oct. 1991 34 p Sponsored by National Swedish Board for Technical Development
(FFA-TN-1990-19; ETN-92-91058) Avail: NTIS HC/MF A03

MATGRID is a computer program for generation of C-H or C-O topology grids for the discretization of flow fields around configurations consisting of a wing alone or a wing and a fuselage. It was developed within the cooperative program MATGRID/MATRICS primarily for use together with the full potential flow solver MATRICS (Multi Component Aircraft Transonic Inviscid Computation System). The mathematical principles used in the construction of the grid generation procedure are described. ESA

N92-20473# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
INVISCID DRAG PREDICTION FOR TRANSONIC TRANSPORT WINGS USING A FULL-POTENTIAL METHOD
J. vanderVooren and A. J. vanderWees 8 Nov. 1989 23 p Presented at the 28th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, 8-11 Jan. 1990
(Contract NIVR-01501N)
(NLR-TP-89365-U; ETN-92-90961) Avail: NTIS HC/MF A03

A theory of drag analysis in full potential flow, based on generalization and extension of Garabedian's and McFadden's idea of determining wave drag by volume integration of the artificial viscosity, is summarized. An illustrative example demonstrates that the theory predicts the change in wave drag on a wing between a fully conservative and a nonconservative solution qualitatively correct and quantitatively realistic. A series of mesh definement experiments on nested grids was carried out for a DFVLR F4 wing in transonic flow, using CH as well as CO topology grids, with the purpose of providing insight into the accuracy of inviscid drag prediction for transonic transport wings. The MATRICS code used in the experiments is first order accurate in the mesh size throughout supersonic flow regions. In particular in CO topology grids, where the improved wing tip resolution generally resolves the tip vortex much better than on CH topology grids, the velocities in the core of this requires a local modification of the flow model. CO topology grids are concluded to be better suited for drag analysis than are CH topology grids. Another conclusion is that the accuracy of each individual drag component can be improved by extrapolating to the limit of vanishing mesh size. In order to avoid excessively fine grids in an engineering environment, the need for artificial viscosity terms that are second order small in the mesh size in supersonic flow regions, except for the immediate vicinity of the shock waves, is stressed. Extrapolation procedures are believed then however to remain necessary for accurate drag prediction. ESA

N92-20480*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
QUALITY ASSESSMENT OF TWO- AND THREE-DIMENSIONAL UNSTRUCTURED MESHES AND VALIDATION OF AN UPWIND EULER FLOW SOLVER
Paul R. Woodard, Henry T. Y. Yang (Purdue Univ., West Lafayette, IN.), and John T. Batina Feb. 1992 15 p Presented at the AIAA 30th Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992
(NASA-TM-104215; NAS 1.15:104215) Avail: NTIS HC/MF A03 CSCL 01A

Quality assessment procedures are described for two-dimensional and three-dimensional unstructured meshes. The procedures include measurement of minimum angles, element aspect ratios, stretching, and element skewness. Meshes about the ONERA M6 wing and the Boeing 747 transport configuration are generated using an advancing front method grid generation package of programs. Solutions of Euler's equations for these meshes are obtained at low angle-of-attack, transonic conditions. Results for these cases, obtained as part of a validation study demonstrate the accuracy of an implicit upwind Euler solution algorithm. Author

N92-20494*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
COMPARISON OF A TWO-DIMENSIONAL ADAPTIVE-WALL TECHNIQUE WITH ANALYTICAL WALL INTERFERENCE CORRECTION TECHNIQUES
Raymond E. Mineck Apr. 1992 73 p

(NASA-TP-3132; L-16911; NAS 1.60:3132) Avail: NTIS HC/MF A04 CSCL 01A

A two dimensional airfoil model was tested in the adaptive wall test section of the NASA Langley 0.3 meter Transonic Cryogenic Tunnel (TCT) and in the ventilated test section of the National Aeronautical Establishment Two Dimensional High Reynold Number Facility (HRNF). The primary goal of the tests was to compare different techniques (adaptive test section walls and classical, analytical corrections) to account for wall interference. Tests were conducted over a Mach number range from 0.3 to 0.8 at chord Reynolds numbers of 10 x 10(exp 6), 15 x 10(exp 6), and 20 x 10(exp 6). The angle of attack was varied from about 12 degrees up to stall. Movement of the top and bottom test section walls was used to account for the wall interference in the HRNF tests. The test results are in good agreement. Author

N92-20498# National Aerospace Lab., Amsterdam (Netherlands). Fluid Dynamics Div.

NUMERICAL SIMULATION OF VORTICAL FLOW OVER A DELTA WING AT SUBSONIC AND TRANSONIC SPEEDS

H. W. M. Hoeijmakers, J. M. J. W. Jacobs, and J. I. vandenBerg 1 May 1990 19 p Presented at the 17th ICAS Congress, 9-14 Sep. 1990. Stockholm, Sweden Sponsored by Netherlands Agency for Aerospace Programs and Ministry of Defence

(NLR-TP-90029-U; ETN-92-90962) Avail: NTIS HC/MF A03

The flow about a 65 degree sharp edged cropped delta wing is simulated by solving the Euler equations. Solutions are obtained for the wing at a subsonic, free stream Mach number and high angle of attack, where a strong vortex forms above the wing upper surface as well as for the wing at a transonic free stream Mach number and high incidence resulting in shocks and strong vortices. For the latter case the development of the flow field with the incidence is studied, while for both cases the formation of the wake downstream of the trailing edge is investigated. The influence of the mesh resolution on the details of the solution is analyzed utilizing a mesh of 0-0 topology, which on its finest level has more than one million grid points in the half space around the starboard side of the delta wing. ESA

N92-20545*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

DIFFRACTED AND HEAD WAVES ASSOCIATED WITH WAVES ON NONSEPARABLE SURFACES

Raymond L. Barger Apr. 1992 17 p

(NASA-TP-3169; L-16968; NAS 1.60:3169) Avail: NTIS HC/MF A03 CSCL 01A

A theory is presented for computing waves radiated from waves on a smooth surface. With the assumption that attention of the surface wave is due only to radiation and not to dissipation in the surface material, the radiation coefficient is derived in terms of the attenuation factor. The excitation coefficient is determined by the reciprocity condition. Formulas for the shape and the spreading of the radiated wave are derived, and some sample calculations are presented. An investigation of resonant phase matching for nonseparable surfaces is presented with a sample calculation. A discussion of how such calculations might be related to resonant frequencies of nonseparable thin shell structures is included. A description is given of nonseparable surfaces that can be modeled in the vector that facilitates use of the appropriate formulas of differential geometry. Author

N92-20654*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

UNSTEADY-PRESSURE AND DYNAMIC-DEFLECTION MEASUREMENTS ON AN AEROELASTIC SUPERCRITICAL WING

David A. Seidel, Maynard C. Sandford, and Clinton V. Eckstrom Washington Dec. 1991 315 p

(NASA-TM-4278; L-16906; NAS 1.15:4278) Avail: NTIS HC/MF A14 CSCL 01A

Transonic steady and unsteady pressure tests were conducted on a large elastic wing. The wing has a supercritical airfoil, a full span aspect ratio of 10.3, a leading edge sweepback angle of 28.8 degrees, and two inboard and one outboard trailing edge control surfaces. Only the outboard control surface was deflected statically and dynamically to generate steady and unsteady flow over the wing. The unsteady surface pressure and dynamic deflection measurements of this elastic wing are presented to permit correlations of the experimental data with theoretical predictions. Author

N92-20674*# Nielsen Engineering and Research, Inc., Mountain View, CA.

IMPROVEMENTS TO THE MISSILE AERODYNAMIC PREDICTION CODE DEMON3 Final Report

Marnix F. E. Dillenius, David L. Johnson, and Daniel J. Lesieutre Washington, DC NASA Mar. 1992 171 p

(Contract NAS1-17077)

(NASA-CR-4432; NAS 1.26:4432; NEAR-TR-435) Avail: NTIS HC/MF A08 CSCL 01A

The computer program DEMON3 was developed for the aerodynamic analysis of nonconventional supersonic configurations comprising a body with noncircular cross section and up to two wing or fin sections. Within a wing or fin section, the lifting surfaces may be cruciform, triform, planar, or low profile layouts; the planforms of the lifting surfaces allow for breaks in sweep. The body and fin sections are modeled by triplet and constant u-velocity panels, respectively, accounting for mutual body-fin interference. Fin thickness effects are included for the use of supersonic planar source panels. One of the unique features of DEMON3 is the modeling of high angle of attack vortical effects associated with the lifting surfaces and the body. In addition, shock expansion and Newtonian pressure calculation methods can be optionally engaged. These two dimensional nonlinear methods are augmented by aerodynamic interference determined from the linear panel methods. Depending on the geometric details of the body, the DEMON3 program can be used to analyze nonconventional configurations at angles of attack up to 25 degrees for Mach numbers from 1.1 to 6. Calculative results and comparisons with experimental data demonstrate the capabilities of DEMON3. Limitations and deficiencies are listed. Author

N92-20797# Advisory Group for Aerospace Research and Development, Neuilly-Sur-Seine (France). Fluid Dynamics Panel Working Group 13.

AIR INTAKES FOR HIGH SPEED VEHICLES

Sep. 1991 263 p

(AGARD-AR-270; ISBN-92-835-0637-5) Copyright Avail: NTIS HC/MF A12; Non-NATO Nationals requests available only from AGARD/Scientific Publications Executive

The results of a study by Working Group 13 of the AGARD Fluid Dynamics Panel are presented. The scope of the investigation included intake aerodynamics, intake/engine compatibility, and intake/airframe integration for both aircraft and missiles. The present capability of Computational Fluid Dynamics (CFD) methods was assessed through a comparative analysis of both CFD predictions and experimental data. This analysis was conducted for eight different flow field test cases designed to produce critical features of air-intake flow fields. Flow field results and comparisons are presented both in the report and in a microfiche appendix. Air-inlet wind tunnel testing techniques and limitations were also investigated and reported. Results from measurements of inlet performance from three European wind tunnels using a common axisymmetric pitot intake are also presented. The participants in Working Group 13 represented Belgium, France, Germany, Italy, the United Kingdom, and the United States. Author

N92-20934*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.

FLOW STUDIES IN CLOSE-COUPLED VENTRAL NOZZLES FOR STOVL AIRCRAFT

Jack G. McArdle and C. Frederic Smith (Sverdrup Technology, Inc., Cleveland, OH.) 1990 23 p Presented at the Aerospace Atlantic Conference, Dayton, OH, 23-26 Apr. 1990; sponsored by

SAE Previously announced in IAA as A91-21242
(NASA-TM-102554; E-5369; NAS 1.15:102554; SAE-901033)
Avail: NTIS HC/MF A03 CSCL 01A

Flow in a generic ventral nozzle system was studied experimentally and analytically with the PARC3D computational fluid dynamics program in order to evaluate the program's ability to predict system performance and internal flow patterns. A generic model of a tailpipe with a rectangular ventral nozzle, about 1/3 of full size, was tested with unheated air at steady state pressure ratios up to 4.0. The end of the tailpipe was closed to simulate a blocked exhaust nozzle. Flow behavior into and through the ventral duct is discussed and illustrated with paint streak flow visualization photographs. PARC3D graphic images are shown for comparison with the experimental photographs. The program successfully predicted internal flow patterns; it also computed thrust and discharge coefficients within 1 pct. of measured values. Author

N92-21012# Naval Postgraduate School, Monterey, CA.
A QUANTITATIVE STUDY OF UNSTEADY COMPRESSIBLE FLOW ON AN OSCILLATING AIRFOIL
L. W. Carr, M. S. Chandrasekhara, and N. J. Brock Jun. 1991 18 p Presented at the 22nd AIAA Fluid Dynamics, Plasma Dynamics, and Lasers Conference, Honolulu, HI, 24-26 Jun. 1991 Previously announced in IAA as A91-43590
(Contract MIPR-ARO-114-91)
(AD-A244572; ARO-27894.7-EG) Avail: NTIS HC/MF A03 CSCL 01/1

Detailed interferometric measurements of the flow near the leading edge of an oscillating airfoil offer the first detailed experimental quantification of the locally compressible flow field that surrounds an oscillating airfoil at moderate subsonic Mach numbers. Interferograms obtained by a specially adapted real-time point-diffraction interferometry technique have revealed significant characteristics of this complex, and very rapidly varying, locally supersonic flow. Instantaneous pressure distributions determined from these interferograms document the effect of unsteadiness on the leading-edge flow environment. GRA

03 AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

For related information see also *16 Space Transportation* and *85 Urban Technology and Transportation.*

N92-20156# National Research Council of Canada, Ottawa (Ontario). Inst. for Mechanical Engineering.
FREEZING PRECIPITATION ON LIFTING SURFACES
M. M. Oleskiw Sep. 1991 39 p
(NRC-32124; IME-CRE-TR-003; CTN-92-60430) Avail: NTIS HC/MF A03

On March 10, 1989 an Air Ontario Fokker F-28 crashed during an attempted take-off from the airport at Dryden, Ontario in wet snow conditions. Witnesses reported that snow on the wings appeared to turn to ice during the take-off roll. As part of an investigation into the crash, the National Research Council of Canada Low Temperature Laboratory has undertaken an investigation of the quantity and form of the precipitation adhering the wings during the take-off attempt. Since precipitation measurements during the period of the stopover were unavailable, an empirical formula, utilizing the visibility recorded by the weather observer and by a transmissometer, was used to provide an estimate of 1.38 mm of snowfall. A thermodynamic analysis of the influence of take-off roll upon the precipitation layer on the wings indicated that no significant change caused by the movement of the aircraft occurred during this interval. However, the wing tank fuel temperature during the final stopover was calculated to be below 0 C. Therefore, heat removed from the lower portion of the wet snow layer may have caused freezing of the liquid portion of the snow. As a result when the upper snow layer was blown away during the take-off roll, it likely left behind a very rough ice layer on the wing. This rough layer may have had a very serious effect on the aircraft's aerodynamic performance. CISTI

N92-20303 Toledo Univ., OH.
NUMERICAL SIMULATION OF AN AIRCRAFT ANTI-ICING SYSTEM INCORPORATING A RIVULET MODEL FOR THE RUNBACK WATER Ph.D. Thesis
Kamel Mahmoud Al-Khalil 1991 212 p
Avail: Univ. Microfilms Order No. DA9200761

A numerical simulation of the anti-icing of aircraft surfaces is presented. A basic runback model was developed for the prediction of the surface water temperature as well as for the solid wall temperature distribution using a one-dimensional heat transfer approach for each domain. A variety of test cases were considered in order to validate the various numerical components of the process as well as to show the procedure. The basic model was then improved using a basic theory regarding the breakup of a uniformly thin liquid film into individual streams or rivulets separated by dry spaces. The concept was used to accurately predict the wetness factor distribution over the surface and to more accurately describe the physics of the runback water. A two-dimensional heat transfer approach is used to calculate the temperature distributions in the runback water and the solid wall. The model allows a multilayer representation of the solid wall with the possibility of heating the surface by means of electrical heating elements embedded within the layers, or by means of convective heating of the surface from the inside using compressor bleed air. Parametric studies were performed to study the effects of some of the problem variables on the results. Dissert. Abstr.

N92-20318# National Oceanic and Atmospheric Administration, Silver Spring, MD. Air Resources Lab.
VORTEX CHARACTERISTICS OF C5A/B, C141B AND C130E AIRCRAFT APPLICABLE TO ATC TERMINAL FLIGHT OPERATIONS TOWER FLY-BY-DATA
L. J. Garodz and K. L. Clawson Aug. 1991 261 p
(PB92-114586; NOAA-TM-ERL-ARL-190) Avail: NTIS HC/MF A12 CSCL 01C

Newly acquired military transport aircraft vortex wake data was examined for application to existing Air Traffic Control (ATC) terminal area flight operations. The data was examined for application to simultaneously parallel runway operations. The full scale vortex flight test data were obtained by the NOAA Air Resources Lab Field Research Div. using the tower fly-by technique. The aircraft studied were U.S. Air Force large jet transports from the Military Airlift Command, namely, the Lockheed C5A/B Galaxy, the C14B Starlifter, and C130E Hercules. The data were collected and analyzed for military purposes. However, the type of data that was collected permitted further analysis, including vortex persistence and transported at low altitudes. A secondary purpose was to attempt to determine a correlation parameter(s), other than ambient wind velocity, for vortex persistence (age). The plan was to correlate vortex persistence with atmospheric conditions existing during the time of flight tests were conducted. This was, of course, dependent on appropriate supporting flight test data. Author

N92-20794# Cranfield Inst. of Tech., Bedford (England). Centre for Transport Studies.
AN EVALUATION OF IN-CABIN SAFETY FEATURES IN PASSENGER AIRCRAFT M.S. Thesis
D. J. Nicol Aug. 1990 209 p
(ETN-92-90656) Copyright Avail: NTIS HC/MF A10

Aircraft passenger safety considerations are evaluated. The advantages of providing smokehoods for passengers and an onboard tender-fed water mist spray system are considered. Cabin configuration, with special reference to seat pitch and aisle width in and around emergency exits, is considered. Safety features which might improve the egress capability of passengers after a survival accident are evaluated within an economic framework. A mathematical model, to be used to determine the effect of cost

and weight of various proposed safety features, is developed.
ESA

04 AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

For related information see also *17 Space Communications, Spacecraft Communications, Command and Tracking* and *Communications and Radar.*

N92-20356 Rice Univ., Houston, TX.
A CONNECTIONIST APPROACH TO AUTONOMOUS ROBOTIC NAVIGATION Ph.D. Thesis
Peter Lawrence Weiland 1991 278 p
Avail: Univ. Microfilms Order No. DA9136080

Robotic navigation for mobile robot development was examined. A navigation system is presented which is based on biological and behavioral principles which functions in a stimulus-response manner. Using connectionist architectures, a relationship between stimulus and response is required through the learning of conceptual information pertaining to navigation. In this research, the mammalian visual system provides a guide for the processing of environmental stimulus. Simulated laser range data are processed in retinal patch size elements by a cellular neural network. This network is designed to detect obstacle existence for each patch segment based on an invariant feature of range discontinuity. Obstacle information is then mapped in binary format, indicating the traversable state of the patch, to the system's visual cortex. Response to this mapping is derived from a hierarchical structure of back error propagation neural networks in which each network has learned a particular navigational behavior - obstacle avoidance, wander, and goal seeking. Output from these networks indicate an appropriate motor response for the environmental stimulus. A simulation was developed to evaluate the performance of this system by having a robot traverse an environment. The connectionist approach was verified through system display of human-like navigational behavior for the simulation's environment. Advantages of the neural network approach were also demonstrated by its processing speed and adaptability. Procedures are discussed for actual system implementation in which cycle times of under one second are completely feasible. Dissert. Abstr.

N92-20818# Gesellschaft fuer Mathematik und Datenverarbeitung, Saint Augustin (Germany, F.R.).
TOWARDS COHERENT HYPERMEDIA NAVIGATION BY PRAGMATIC DIALOGUE MODELING
A. Stein, U. Thiel, and A. Tissen 1991 21 p
(PB92-114735; GMD-580) Copyright Avail: NTIS HC/MF A03 CSCL 17G

The successful use of hypermedia systems is often impeded by user disorientation or cognitive overhead caused by the non-linear arrangement of hypertext nodes. Addressed here is the related problem of how a user can be supported in his construction of coherence during the navigation through a hyperdocument. Instead of leaving this task to the hypertext author or designer alone, it proposes to share the responsibility among author, user, and system. As a consequence, it claims that hypermedia systems should apply a progmatic model of navigation to achieve intelligent dialog control. It chooses a case-based architecture. The case-based dialog manager (CADI) disposes of several dialogue plans and can adapt the current plan to the dialogue situation. The user determines the concrete navigation course by selecting a thematical perspective. A prototype (accessing a conference information base) shows the feasibility of assembling the contents of nodes with respect to a user perspective. The nodes are automatically filled with information from the underlying knowledge base. Author

N92-20834# Department of the Navy, Washington, DC.
A METHOD OF PASSIVE RANGE DETERMINATION USING ONLY TWO BEARING MEASUREMENTS Patent Application
Anthony F. Bessacini, inventor (to Navy) 2 Oct. 1991 12 p
(AD-D015182; US-Patent-Appl-SN-769685) Avail: NTIS HC/MF A03 CSCL 17/7

A method of determining range from a moving vessel to an approaching object using only two bearing measurements is provided. At a first point in time, a first bearing measurement to the approaching object is obtained using the vessel's conventional bearing sensor. The vessel and approaching object are then postulated to be on an intercept course based on the vessel's first velocity vector and first bearing measurement. At a second point in time, the vessel commences a maneuver to a known second velocity vector different from the first velocity vector. Then, at a third point in time, a second bearing measurement to the approaching object is obtained using the vessel's bearing sensor. At the same third point in time, a virtual bearing to the approaching object is provided as if the vessel and the approaching object were on the postulated intercept course. A time difference is computed between the second and third points in time and standard trigonometric methods are applied to determine the range to the approaching object. The determined range is accurate when the approaching object is on an actual intercept course.
Author (GRA)

N92-20902# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Hamburg (Germany, F.R.). Abt. Luft- und Raumfahrtpsychologie.
FLYING AN AIRCRAFT AS A PROBLEM-SOLVING PROCESS: ABOUT THE INSTRUMENT-FAILURE-SIMULATOR (IFS) AS A TEST FOR PILOT-CANDIDATES Ph.D. Thesis - Hamburg Univ.
Gerhard Fahnenbruck Jun. 1991 117 p In GERMAN; ENGLISH summary
(DLR-FB-91-23; ISSN-0939-2963; ETN-92-90738) Avail: NTIS HC/MF A06; DLR, Wissenschaftliches Berichtswesen, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC 38.50 DM

The IFS was developed on the basis of a theoretical model, showing how pilots fly. The simulator was equipped with instruments which systemically break down. The subjects had to fly and follow a relatively simple track several times, while scanning the instruments for failure. The performance was rated on the basis of the distance between the actual flight path and the given track, and on the ability to detect instrument failures. The results show that the IFS and the model can be used to predict professional success. The model can be used successfully to develop a test for airlines simulators. ESA

N92-20611 Compagnia Italiana Servizi Tecnici, Rome.
STANDARDS AND S/W DEVELOPMENT ENVIRONMENTS; THE POINT OF VIEW OF A S/W ENGINEERING COMPANY INVOLVED IN SEVERAL SPACE PROGRAMS
E. Ancillotto and R. Berni *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 271-279
Previously announced in IAA as A91-47773 (For primary document see N92-20589 11-61)
Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

05 AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

For related information see also *18 Spacecraft Design, Testing and Performance* and *39 Structural Mechanics.*For land transportation vehicles see *85 Urban Technology and Transportation.*

N92-20064*# Kansas Univ., Lawrence.
PRELIMINARY DESIGN STUDIES OF AN ADVANCED GENERAL AVIATION AIRCRAFT Summary Report

Ron Barrett, Shane DeMoss, Ab Dirkzwager, Darryl Evans, Charles Gomer, Jerry Keiter, Darren Knipp, Glen Seier, Steve Smith, and Ed Wenninger May 1991 204 p Original contains color illustrations
(Contract NASw-4435)
(NASA-CR-190024; NAS 1.26:190024) Avail: NTIS HC/MF A10; 5 functional color pages CSCL 01C

The preliminary design results are presented of the advanced aircraft design project. The goal was to take a revolutionary look into the design of a general aviation aircraft. Phase 1 of the project included the preliminary design of two configurations, a pusher, and a tractor. Phase 2 included the selection of only one configuration for further study. The pusher configuration was selected on the basis of performance characteristics, cabin noise, natural laminar flow, and system layouts. The design was then iterated to achieve higher levels of performance. Author

N92-20267*# Auburn Univ., AL. Dept. of Aerospace Engineering.
THE FM-007: AN ADVANCED JET COMMUTER FOR HUB TO SPOKE TRANSPORTATION
Peter Scott Blouke, George Bryan Engel, Kari Suzanne Fordham, Steven James Layne, Joel David Moore, Frederick Martin Shaver, and Douglas Hershal Thornton, Jr. 14 May 1991 70 p
(Contract NASw-4435)
(NASA-CR-189988; NAS 1.26:189988) Avail: NTIS HC/MF A04 CSCL 01C

Due to the increasing need for new commuter aircraft, the FM-007 is proposed, a technologically advanced jet propelled short takeoff and landing (STOL) airplane. The proposed commuter is designed for hub to spoke air travel. In order to reduce drag, natural laminar flow technology is integrated into the design using the natural laminar flow airfoil section for the wing. A three lifting surface configuration provides for more efficient cruise flight. This unique design includes a small forward wing (canard), a rear mounted high aspect ratio main wing, and a small horizontal stabilizer high atop the vertical tail. These three surfaces act together to reduce drag by minimizing the downward force the horizontal stabilizer has to account for due to the nose down pitching moment. Commuter aircraft must also incorporate passenger comfort. This is achieved by providing a spacious pressurized cabin with a large galley and reduced cabin noise due to incorporation of noise reduction gear. A basic oval design is adopted, as opposed to a circular design in order to allow for the seating of five passengers abreast. To get STOL capability, an over the wing blown flap is used using a Rolls Royce Tay series engine. Author

N92-20280*# Purdue Univ., West Lafayette, IN. School of Aeronautics and Astronautics.
DESIGN OF A TURBOFAN POWERED REGIONAL TRANSPORT AIRCRAFT Final Report
[1991] 12 p
(Contract NASw-4435)
(NASA-CR-190130; NAS 1.26:190130) Avail: NTIS HC/MF A03 CSCL 01C

The majority of the market for small commercial transport aircraft is dominated by high efficiency propeller driven aircraft of non-U.S. manufacture. During the past year, an aircraft was designed with ranges of up to 1500 nautical miles and passenger loads between 50 and 90. Special emphasis was placed upon keeping acquisition cost and direct operating costs at a low level while providing passengers with quality comfort levels. Several designs are presented which place a high premium on design innovation. Author

N92-20417*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
FULLY INTEGRATED AERODYNAMIC/DYNAMIC OPTIMIZATION OF HELICOPTER ROTOR BLADES
Joanne L. Walsh, William J. LaMarsh, II (Unisys Corp., Hampton, VA.), and Howard M. Adelman Feb. 1992 18 p Proposed for presentation at the 33rd AIAA, ASME, ASCE, AHS, and ASC Structures, Structural Dynamics and Materials Conference, Dallas, TX, 13-15 Apr. 1992
(NASA-TM-104226; NAS 1.15:104226) Avail: NTIS HC/MF A03 CSCL 01C

A fully integrated aerodynamic/dynamic optimization procedure is described for helicopter rotor blades. The procedure combines performance and dynamic analyses with a general purpose optimizer. The procedure minimizes a linear combination of power required (in hover, forward flight, and maneuver) and vibratory hub shear. The design variables include pretwist, taper initiation, taper ratio, root chord, blade stiffnesses, tuning masses, and tuning mass locations. Aerodynamic constraints consist of limits on power required in hover, forward flight and maneuvers; airfoil section stall; drag divergence Mach number; minimum tip chord; and trim. Dynamic constraints are on frequencies, minimum autorotational inertia, and maximum blade weight. The procedure is demonstrated for two cases. In the first case, the objective function involves power required (in hover, forward flight and maneuver) and dynamics. The second case involves only hover power and dynamics. The designs from the integrated procedure are compared with designs from a sequential optimization approach in which the blade is first optimized for performance and then for dynamics. In both cases, the integrated approach is superior. Author

N92-20500# Israel Aircraft Industries Ltd., Ben-Gurion Airport. TASHAN Engineering Center
A REVIEW OF AGING AIRCRAFT TECHNOLOGY: AN IAI PERSPECTIVE
Abraham Brot and Arnold Nathan May 1991 15 p
(IAITIC-91-1018; ITN-92-85138) Avail: NTIS HC/MF A03

Considerations in the maintenance of aging aircraft are reviewed and discussed, including the use of a logistics computer program for optimal maintenance scheduling, quantitative ranking of critical locations for maintenance, a comparative evaluation of proof testing and preloading as a means of life extension. The primary cause of increasing costs of repair and replacement of parts has been found to be corrosion damage. This causes maintenance costs eventually to rise to the point where the aircraft has to be retired. Israel Aircraft Industries (IAI) has developed non-destructive inspection procedures, based on low-frequency eddy-current methods, to detect potential cracking problems, to enable spares to be ordered and stocked in advance. Considerations in critical-location ranking include corrosion susceptibility, stress level, accessibility, geometry and past experience. Tests have indicated that preloading to 1.33-1.5 times the normal operating load can extend service life by a factor of 1.2-4.6. Preloading is recommended before the aircraft enters service and on 1-3 occasions during its service life. This treatment should be paralleled by non-destructive inspection at appropriate intervals. ISA

N92-20512*# California Polytechnic State Univ., San Luis Obispo. Dept. of Aeronautical Engineering.
CYCLONE: A CLOSE AIR SUPPORT AIRCRAFT FOR TOMORROW
George Cox, Donald Croulet, James Dunn, Michael Graham, Phillip Ip, Scott Low, Gregg Vance, and Eric Volckaert 25 Nov. 1991 109 p
(Contract NASw-4435)
(NASA-CR-189980; NAS 1.26:189980) Avail: NTIS HC/MF A06 CSCL 01C

To meet the threat of the battlefield of the future, the U.S. ground forces will require reliable air support. To provide this support, future aircrews demand a versatile close air support aircraft capable of delivering ordinance during the day, night, or in adverse weather with pin-point accuracy. The Cyclone aircraft meets these requirements, packing the 'punch' necessary to clear the way for effective ground operations. Possessing anti-armor, missile, and precision bombing capability, the Cyclone will counter the threat into the 21st Century. Here, it is shown that the Cyclone is a realistic, economical answer to the demand for a capable close air support aircraft. Author

N92-20531# Israel Aircraft Industries Ltd., Lod.
THE USE OF THE CTS FOR PREDICTION OF TRAJECTORIES TO THE IMPACT POINT
M. Zilberman, M. Shay, A. Shlezinger, I. Shruster, and Ts. Cohen Dec. 1990 22 p
(IAITIC-90-1016; ITN-92-85136) Avail: NTIS HC/MF A03

The Captive Trajectory System (CTS) at Israel Aircraft Industries (IAI) is mainly used for predicting separation of stores from parent vehicles. The system serves as a main tool in separation analysis, either by operating in a closed loop (CTS) or in an open loop (grid) scheme. Owing to the high level of correlation between wind tunnel and flight test results, the use of the system has been extended to predict the effect of separation on the trajectory of a store to the impact point. In the last year, a long-term effort, in which the full trajectory of several stores is predicted has been initiated at IAI. This paper presents the results which were obtained for the trajectories of low-drag Mk-84 and Mk-82 stores which were released from station 3 of an F-16 parent aircraft at several flight conditions in the transonic range. It is shown that the aircraft/store interferences has only little effect on the ground distance of the Mk-84. On the other hand, the ground distance which was obtained for the Mk-82 store was significantly affected by the interference, and the ground distance was sensitive to the position on the TER (Triple Ejection Rack) from which the store was released. Author (ISA)

N92-20664*# California Polytechnic State Univ., San Luis Obispo. Dept. of Aeronautical Engineering.
SCORPION: CLOSE AIR SUPPORT (CAS) AIRCRAFT
Chris Allen, Rendy Cheng, Grant Koehler, Sean Lyon, and Cecilia Paguio 25 Nov. 1991 107 p
(Contract NASw-4435)
(NASA-CR-189974; NAS 1.26:189974) Avail: NTIS HC/MF A06 CSCL 01C

The objective is to outline the results of the preliminary design of the Scorpion, a proposed close air support aircraft. The results obtained include complete preliminary analysis of the aircraft in the areas of aerodynamics, structures, avionics and electronics, stability and control, weight and balance, propulsion systems, and costs. A conventional wing, twin jet, twin-tail aircraft was chosen to maximize the desirable characteristics. The Scorpion will feature low speed maneuverability, high survivability, low cost, and low maintenance. The life cycle cost per aircraft will be 17.5 million dollars. The maximum takeoff weight will be 52,760 pounds. Wing loading will be 90 psf. The thrust to weight will be 0.6 lbs/lb. This aircraft meets the specified mission requirements. Some modifications have been suggested to further optimize the design. Author

N92-20665*# Worcester Polytechnic Inst., MA.
NASA ADVANCED AERONAUTICS DESIGN SOLAR POWERED REMOTELY PILOTED VEHICLE
David S. Elario, Neal H. Guillmette, Gregory S. Lind, Jonathan D. Webster, Michael J. Ferreira, George C. Konstantakis, David L. Marshall, and Cari L. Windt 30 Apr. 1991 318 p
(Contract NASw-4435)
(NASA-CR-190007; NAS 1.26:190007) Avail: NTIS HC/MF A14 CSCL 01C

Environmental problems such as the depletion of the ozone layer and air pollution demand a change in traditional means of propulsion that is sensitive to the ecology. Solar powered propulsion is a favorable alternative that is both ecologically harmless as well as cost effective. Integration of solar energy into designs ranging from futuristic vehicles to heating is beneficial to society. The design and construction of a Multi-Purpose Remotely Piloted Vehicle (MPRPV) seeks to verify the feasibility of utilizing solar propulsion as a primary fuel source. This task has been a year long effort by a group of ten students, divided into five teams, each dealing with different aspects of the design. The aircraft was designed to take-off, climb to the design altitude, fly in a sustained figure-eight flight path, and cruise for approximately one hour. This mission requires flight at Reynolds numbers between 150,000 and 200,000 and demands special considerations in the aerodynamic design in order to achieve flight in this regime. Optimal performance requires a light weight configuration with both structural integrity and maximum power availability. The structure design and choice of solar cells for the propulsion was governed by the weight, efficiency, and cost considerations. The final design is a MPRPV weighting 35 N which cruises 7 m/s at the design altitude of 50 m. The configuration includes a wing composed of balsa and foam NACA 6409 airfoil sections and carbon fiber spars, a tail of similar construction, and a truss structure fuselage. The propulsion system consists of 98 10 percent efficient solar cells donated by Mobil Solar, a NiCad battery for energy storage, and a folding propeller regulated by a lightweight and efficient control system. The airfoils and propeller chosen for the design were research and tested during the design process. Author

N92-20795# Cranfield Inst. of Tech., Bedford (England). Dept. of Aerospace Vehicle Design.
A FATIGUE ANALYSIS OF THE TF89 TACTICAL FIGHTER AIRCRAFT M.S. Thesis
D. C. Ellis Sep. 1990 188 p
(ETN-92-90657) Copyright Avail: NTIS HC/MF A09

The fatigue life of the TF89 tactical fighter aircraft is determined. Five representative mission profiles are evolved and proportioned to describe the life of the airplane. These form the basis of all subsequent calculations. Analysis of maneuver, gust and ground loads is undertaken to determine the normal and lateral load spectra that would be applied to the airplane during its service life. These spectra are used to perform S-N curve and fracture mechanics analyses of selected metal components to test them for compliance with the relevant defense standard. ESA

N92-20875*# California Polytechnic State Univ., San Luis Obispo.
THE ELIMINATOR: A DESIGN OF A CLOSE AIR SUPPORT AIRCRAFT
Mandy Hendrix, Ty Hoang, Alex Kokolios, Sharon Selyem, Mark Wardell, and David Winterrowd 25 Nov. 1991 94 p
(Contract NASw-4435)
(NASA-CR-190025; NAS 1.26:190025) Avail: NTIS HC/MF A05 CSCL 01C

The Eliminator is the answer to the need for an affordable, maintainable, survivable, high performance close air support aircraft primarily for the United States, but with possible export sales to foreign customers. The Eliminator is twin turbofan, fixed wing aircraft with high mounted canards and low mounted wings. It is designed for high subsonic cruise and an attack radius of 250 nautical miles. Primarily it would carry 20 500 pound bombs as its main ordnance , but is versatile enough to carry a variety of weapons configurations to perform several different types of missions. It carries state of the art navigation and targeting systems to deliver its payload with pinpoint precision and is designed for maximum survivability of the crew and aircraft for a safe return and quick turnaround. It can operate from fields as short as 1800 ft. with easy maintenance for dispersed operation during hostile situations. It is designed for exceptional maneuverability and could be used in a variety of roles from air-to-air operations to anti-submarine warfare and maritime patrol duties. Author

N92-20951*# Notre Dame Univ., IN. Dept. of Aerospace and Mechanical Engineering.
ALPHA GROUP: THE BEHEMOTH APTERYX. FINAL DESIGN PROPOSAL Advanced Design Program, 1990 - 1991
May 1991 85 p
(Contract NASw-4435)
(NASA-CR-190026; NAS 1.26:190026) Avail: NTIS HC/MF A05 CSCL 01C

The participation of the University of Notre Dame's Alpha Design Group in the NASA/Universities Space Research Association (USRA) University Advanced Design Program for the 1990 to 1991 academic year is presented. Alpha Design Group presented a design for an aircraft called The Behemoth Apteryx. D.R.D.

06 AIRCRAFT INSTRUMENTATION

Includes cockpit and cabin display devices; and flight instruments.

For related information see also *19 Spacecraft Instrumentation* and *35 Instrumentation and Photography.*

N92-20546*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
VENTURI AIR-JET VACUUM EJECTORS FOR HIGH-VOLUME ATMOSPHERIC SAMPLING ON AIRCRAFT PLATFORMS
Gerald F. Hill, Glen W. Sachse, Douglas C. Young, Larry O. Wade (Lockheed Engineering and Sciences Co., Hampton, VA.), and Lewis G. Burney Apr. 1992 38 p
(NASA-TP-3183; L-16937; NAS 1.60:3183) Avail: NTIS HC/MF A03 CSCL 01D

Documentation of the installation and use of venturi air-jet vacuum ejectors for high-volume atmospheric sampling on aircraft platforms is presented. Information on the types of venturis that are useful for meeting the pumping requirements of atmospheric-sampling experiments is also presented. A description of the configuration and installation of the venturi system vacuum line is included with details on the modifications that were made to adapt a venturi to the NASA Electra aircraft at GSFC, Wallops Flight Facility. Flight test results are given for several venturis with emphasis on applications to the Differential Absorption Carbon Monoxide Measurement (DACOM) system at LaRC. This is a source document for atmospheric scientists interested in using the venturi systems installed on the NASA Electra or adapting the technology to other aircraft. Author

07 AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxilliary power plants for aircraft.

For related information see also *20 Spacecraft Propulsion and Power, 28 Propellants and Fuels,* and *44 Energy Production and Conversion.*

N92-20179# Rolls-Royce Ltd., Derby (England).
USE OF CFD IN THE DESIGN OF A MODERN MULTISTAGE AERO ENGINE LP TURBINE DESIGN
C. T. J. Scrivener, C. F. Connolly, J. C. Cox, and G. M. Dailey 1 Apr. 1991 11 p
(PNR-90862; ETN-92-90851) Copyright Avail: NTIS HC/MF A03

Modern civil aeroengines require turbomachinery components of the highest possible efficiency. Furthermore the blading must be simultaneously designed for minimum cost and weight whilst remaining consistent with the highest possible durability. Satisfying all these requirements culminates in a component offering a competitive advantage to the customer. The role of three dimensional viscous computational fluid dynamics methods in the design of a modern multistage LP turbine is described. These methods have now advanced to the state where they can be used during the design iteration to determine the aerofoil geometry. Technical issues addressed by these methods include separation bubbles, aerofoil stack and lean for optimum performance, flow deviation, incidence sensitivity and the control of secondary flows. ESA

N92-20196*# Toledo Univ., OH. Dept. of Chemical Engineering.
COMPUTER CODE FOR PRELIMINARY SIZING ANALYSIS OF AXIAL-FLOW TURBINES Final Report
Arthur J. Glassman Washington NASA. Lewis Research Center Feb. 1992 17 p
(Grant NAG3-1165)
(NASA-CR-4430; E-6150; NAS 1.26:4430) Avail: NTIS HC/MF A03 CSCL 21E

This mean diameter flow analysis uses a stage average velocity diagram as the basis for the computational efficiency. Input design requirements include power or pressure ratio, flow rate, temperature, pressure, and rotative speed. Turbine designs are generated for any specified number of stages and for any of three types of velocity diagrams (symmetrical, zero exit swirl, or impulse) or for any specified stage swirl split. Exit turning vanes can be included in the design. The program output includes inlet and exit annulus dimensions, exit temperature and pressure, total and static efficiencies, flow angles, and last stage absolute and relative Mach numbers. An analysis is presented along with a description of the computer program input and output with sample cases. The analysis and code presented herein are modifications of those described in NASA-TN-D-6702. These modifications improve modeling rigor and extend code applicability. Author

N92-20436# Rolls-Royce Ltd., Colne (England).
SUPERPLASTIC APPLICATIONS IN AERO ENGINES
J. O. Fowler 12 Nov. 1990 4 p
(PNR-90788; ETN-92-90842) Copyright Avail: NTIS HC/MF A01

Superplastic Forming with Diffusion Bonding (SPF/DB) and/or without diffusion bonding (SPF) are identified as cost and weight effective methods of manufacture for critical rotating parts and static structural components in aeroengines. The basic benefits are well known and include: reduced manufacturing cost; reductions in part weight; short manufacturing lead times; reduced skilled labour content; improved material utilization; elimination of fasteners; stiff structures; design flexibility; complex shapes; high automation potential. In an environment where the price of the product is fixed by the market against a background of intense competitive pressure, manufacturing techniques must be introduced that increases the price/cost ratio and increases the number of engines sold. SPF and SPF/DB contribute in both areas due to reduced manufacturing cost and an improvement in engine performance. ESA

N92-20459# Rolls-Royce Ltd., Derby (England). Airworthiness Services Div.
ETOPS: A DEVELOPING SCENE
D. W. Allard 17 Apr. 1991 18 p
(PNR-90844; ETN-92-90794) Copyright Avail: NTIS HC/MF A03

Extended Range Twin Engine Operations (ETOPS) is concerned with the operations of twin-engine commercial transport aircraft that are more than 60 minutes of single engine flying time from a suitable airfield. The history of ETOPS is traced; the current scene is described; and the next stage in the development of ETOPS is investigated. Bias is given towards engine/powerplant reliability in the ETOPS scenario, although, it is recognized that the reliability of the total aircraft system must be considered. ESA

N92-20460# Rolls-Royce Ltd., Bristol (England).
THE 60 YEARS OF BRISTOL ENGINES
G. M. Lewis 1 Nov. 1990 19 p
(PNR-90845; ETN-92-90795) Copyright Avail: NTIS HC/MF A03

Some of the most significant engineering achievements and historical events that have shaped the Bristol engine factory as it is known today are discussed. A tribute is paid to the late Sir Roy Fedden. Additionally, developments over the last 60 years are outlined. ESA

N92-20523*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PERFORMANCE TESTS OF A CRYOGENIC HYBRID MAGNETIC BEARING FOR TURBOPUMPS
Eliseo DiRusso and Gerald V. Brown 1992 14 p Proposed for presentation at the Third International Symposium on Magnetic Bearings, Alexandria, VA, 29-31 Jul. 1992
(NASA-TM-105627; E-6775; NAS 1.15:105627) Avail: NTIS HC/MF A03 CSCL 21E

Experiments were performed on a Hybrid Magnetic Bearing

designed for cryogenic applications such as turbopumps. This bearing is considerably smaller and lighter than conventional magnetic bearings and is more efficient because it uses a permanent magnet to provide a bias flux. The tests were performed in a test rig that used liquid nitrogen to simulate cryogenic turbopump temperatures. The bearing was tested at room temperature and at liquid nitrogen temperature (-320 F). The maximum speed for the test rig was 14000 rpm. For a magnetic bearing stiffness of 20000 lb/in, the flexible rotor had two critical speeds. A static (nonrotating) bearing stiffness of 85000 lb/in was achieved. Magnetic bearing stiffness, permanent magnet stiffness, actuator gain, and actuator force interaction between two axes were evaluated, and controller/power amplifier characteristics were determined. The tests revealed that it is feasible to use this bearing in the cryogenic environment and to control the rotor dynamics of flexible rotors when passing through bending critical speeds. The tests also revealed that more effort should be placed on enhancing the controller to achieve higher bearing stiffness and on developing displacement sensors that reduce drift caused by temperature and reduce sensor electrical noise. Author

N92-20525*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
DEVELOPMENT OF A STEADY POTENTIAL SOLVER FOR USE WITH LINEARIZED, UNSTEADY AERODYNAMIC ANALYSES
Daniel Hoyniak and Joseph M. Verdon (United Technologies Research Center, East Hartford, CT.) 1991 14 p Presented at the Sixth International Symposium on Unsteady Aerodynamics, Aeroacoustics, and Aeroelasticity of Turbomachines and Propellers, Notre Dame, IN, 15-19 Sep. 1991; sponsored by the International Union for Theoretical and Applied Mechanics
(NASA-TM-105288; E-6620; NAS 1.15:105288) Avail: NTIS HC/MF A03 CSCL 21E

A full potential steady flow solver (SFLOW) developed explicitly for use with an inviscid unsteady aerodynamic analysis (LINFLO) is described. The steady solver uses the nonconservative form of the nonlinear potential flow equations together with an implicit, least squares, finite difference approximation to solve for the steady flow field. The difference equations were developed on a composite mesh which consists of a C grid embedded in a rectilinear (H grid) cascade mesh. The composite mesh is capable of resolving blade to blade and far field phenomena on the H grid, while accurately resolving local phenomena on the C grid. The resulting system of algebraic equations is arranged in matrix form using a sparse matrix package and solved by Newton's method. Steady and unsteady results are presented for two cascade configurations: a high speed compressor and a turbine with high exit Mach number. Author

N92-20573# Rolls-Royce Ltd., Leavesden (England).
APPLICATION OF A WATER DROPLET TRAJECTORY PREDICTION CODE TO THE DESIGN OF INLET PARTICLE SEPARATOR ANTI-ICING SYSTEMS
D. L. Mann and S. C. Tan (Cranfield Inst. of Tech., Bedford, England) 1 Nov. 1990 11 p Sponsored in part by Ministry of Defence
(PNR-90839; ETN-92-90792) Copyright Avail: NTIS HC/MF A03

A dust particle trajectory code is considered. Recent work on the code is described. This includes an ice accretion prediction model suitable for use as a design aid for a wide variety of gas turbine engine inlets, but particularly for particle separator geometries. The calculation of the local heat transfer coefficient is seen to be critical to the success of the ice accretion prediction. The incorporation of a suitable model is described and it is shown that a series of validation tests, carried out on a full scale rig satisfactorily verified the code. A second series of validation experiments, carried out in an icing facility, further shows the prediction model to be appropriate. ESA

N92-20650*# Sverdrup Technology, Inc., Brook Park, OH.
ROTARY ENGINE PERFORMANCE LIMITS PREDICTED BY A ZERO-DIMENSIONAL MODEL
Timothy A. Bartrand and Edward A. Willis Mar. 1992 19 p Presented at the International Congress and Exposition, Detroit, MI, 24-28 Feb. 1992; sponsored in part by Society of Automotive Engineers
(Contract NAS3-25945)
(NASA-CR-189129; E-6880; NAS 1.26:189129) Avail: NTIS HC/MF A03 CSCL 21E

A parametric study was performed to determine the performance limits of a rotary combustion engine. This study shows how well increasing the combustion rate, insulating, and turbocharging increase brake power and decrease fuel consumption. Several generalizations can be made from the findings. First, it was shown that the fastest combustion rate is not necessarily the best combustion rate. Second, several engine insulation schemes were employed for a turbocharged engine. Performance improved only for a highly insulated engine. Finally, the variability of turbocompounding and the influence of exhaust port shape were calculated. Rotary engines performance was predicted by an improved zero-dimensional computer model based on a model developed at the Massachusetts Institute of Technology in the 1980's. Independent variables in the study include turbocharging, manifold pressures, wall thermal properties, leakage area, and exhaust port geometry. Additions to the computer programs since its results were last published include turbocharging, manifold modeling, and improved friction power loss calculation. The baseline engine for this study is a single rotor 650 cc direct-injection stratified-charge engine with aluminum housings and a stainless steel rotor. Engine maps are provided for the baseline and turbocharged versions of the engine. Author

08 AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

For related information see also *05 Aircraft Design, Testing and Performance.*

N92-20148 Virginia Polytechnic Inst. and State Univ., Blacksburg.
A MULTI-LOOP GUIDANCE SCHEME USING SINGULAR PERTURBATION AND LINEAR QUADRATIC REGULATOR TECHNIQUES SIMULTANEOUSLY Ph.D. Thesis
Philip Merton Bushong 1991 162 p
Avail: Univ. Microfilms Order No. DA9200413

A design method for a multiloop mixed discrete continuous trajectory following pitch control algorithm for a generic aerospace vehicle is presented. This design methodology is facilitated by a time scale separation observed in the dynamical system. Two variations of this algorithm are considered, with features and drawbacks of both evaluated. The algorithm is then tested by simulations with two vehicles flying arbitrary trajectories. Results are presented for a thrust vector controlled high performance missile without atmospheric effects, and for a single stage to orbit hypersonic vehicle with both elevator and thrust vector control. It is shown that the control algorithm results in a pitch loop feedback controller that is robust and very stable, and is at least near optimal for the class trajectories considered. No claims of optimality are made for the outer loop, but it is shown in the simulations that the outer loop tracker can do a reasonable job of following the prescribed nominal trajectory. Dissert. Abstr.

N92-20195*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
CONTROL INTEGRATION CONCEPT FOR HYPERSONIC CRUISE-TURN MANEUVERS
David L. Raney and Frederick J. Lallman Feb. 1992 63 p

(NASA-TP-3136; L-16928; NAS 1.60:3136) Avail: NTIS HC/MF A04 CSCL 01C

Piloting difficulties associated with conducting aircraft maneuvers in hypersonic flight are caused in part by the nonintuitive nature of the aircraft response and the stringent constraints anticipated on allowable angle of attack and dynamic pressure variations. An approach is documented that provides precise, coordinated maneuver control during excursions from a hypersonic cruise flight path and the necessary flight condition constraints. The approach is to achieve specified guidance commands by resolving altitude and cross range errors into a load factor and bank angle command by using a coordinate transformation that acts as an interface between outer and inner loop flight controls. This interface, referred to as a 'resolver', applies constraints on angle of attack and dynamic pressure perturbations while prioritizing altitude regulation over cross range. An unpiloted test simulation, in which the resolver was used to drive inner loop flight controls, produced time histories of responses to guidance commands and atmospheric disturbances at Mach numbers of 6, 10, 15, and 20. Angle of attack and throttle perturbation constraints, combined with high speed flight effects and the desire to maintain constant dynamic pressure, significantly impact the maneuver envelope for a hypersonic vehicle. Author

N92-20376*# Boeing Co., Seattle, WA.
APPLICATION OF ANALYSIS TECHNIQUES FOR LOW FREQUENCY INTERIOR NOISE AND VIBRATION OF COMMERCIAL AIRCRAFT
A. E. Landmann, H. F. Tillema, and G. R. MacGregor Jan. 1992 91 p
(Contract NAS1-18027)
(NASA-CR-189555; NAS 1.26:189555; D6-55817) Avail: NTIS HC/MF A05 CSCL 01C

Finite element analysis (FEA), statistical energy analysis (SEA), and a power flow method (computer program PAIN) were used to assess low frequency interior noise associated with advanced propeller installations. FEA and SEA models were used to predict cabin noise and vibration and evaluate suppression concepts for structure-borne noise associated with the shaft rotational frequency and harmonics (less than 100 Hz). SEA and PAIN models were used to predict cabin noise and vibration and evaluate suppression concepts for airborne noise associated with engine radiated propeller tones. Both aft-mounted and wing-mounted propeller configurations were evaluated. Ground vibration test data from a 727 airplane modified to accept a propeller engine were used to compare with predictions for the aft-mounted propeller. Similar data from the 767 airplane was used for the wing-mounted comparisons. Author

N92-20475# National Aerospace Lab., Amsterdam (Netherlands). Aeroelasticity Div.
INVESTIGATION OF A SEMI-EMPIRICAL METHOD TO PREDICT LIMIT CYCLE OSCILLATIONS OF MODERN FIGHTER AIRCRAFT
J. J. Meijer and R. J. Zwaan 23 Mar. 1990 29 p Presented at the AGARD Specialists Meeting on Aircraft Dynamic Loads Due to Flow Separation, Sorrento, Italy, 1-6 Apr. 1990
(NLR-TP-90087-U; ETN-92-90965) Avail: NTIS HC/MF A03

Requirements of modern fighter aircraft to operate with high maneuverability in the transonic speed regime may lead under certain conditions to Limit Cycle Oscillations (LCO), produced by a structural/aerodynamic interaction. Conditions of transonic LCO are moderate angle of attack and Mach numbers ranging from 0.9 to 1.1. An analysis of steady wind tunnel data, obtained for a fighter type aircraft in a typical configuration indicated that shock induced separation plays a dominant role. A semi empirical prediction method which makes use of these steady data is presented and some results are shown. Possibilities to extend the method to the use of unsteady wind tunnel data are discussed. ESA

N92-20586*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
DESIGN AND EVALUATION OF A ROBUST DYNAMIC NEUROCONTROLLER FOR A MULTIVARIABLE AIRCRAFT CONTROL PROBLEM
T. Troudet (Sverdrup Technology, Inc., Brook Park, OH.), S. Garg, and W. Merrill 1992 9 p Proposed for presentation at the International Joint Conference on Neural Networks, Baltimore, MD, 7 Jun. 1992
(NASA-TM-105579; E-6905; NAS 1.15:105579) Avail: NTIS HC/MF A02 CSCL 01C

The design of a dynamic neurocontroller with good robustness properties is presented for a multivariable aircraft control problem. The internal dynamics of the neurocontroller are synthesized by a state estimator feedback loop. The neurocontrol is generated by a multilayer feedforward neural network which is trained through backpropagation to minimize an objective function that is a weighted sum of tracking errors, and control input commands and rates. The neurocontroller exhibits good robustness through stability margins in phase and vehicle output gains. By maintaining performance and stability in the presence of sensor failures in the error loops, the structure of the neurocontroller is also consistent with the classical approach of flight control design. Author

N92-20849# Israel Aircraft Industries Ltd., Ben-Gurion Airport. Dept. of Dynamics and Flight Control.
SOME INTERESTING PHENOMENA FROM LAVI TEST FLIGHTS RELATING TO AIRCRAFT STABILITY AND CONTROL
Moshe Attar Mar. 1991 12 p
(IAITIC-91-1017; ITN-92-85137) Avail: NTIS HC/MF A03

The subject of this paper deals with two interesting phenomena encountered during the flight tests of the Lavi prototypes and the Avionics Systems Technology Demonstrator (T.D.) aircraft. These phenomena are related to: (1) The low damping and pitch oscillations near Mach 0.95; and (2) The pitch-up during slow down turn across Mach 1. In addition, some examples of reproducing flight test results from a six-degrees of freedom simulator and with the 'FFT-GPM' (Fast Fourier Transforms for Gain and Phase Margins) tool are given. Author (ISA)

09 RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

For related information see also *14 Ground Support Systems and Facilities (Space).*

N92-20385# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de l'Aerodynamique.
PHOTOLUMINESCENCE THERMOGRAPHY: PINPOINT STUDY OF A LINEAR LUMINOPHORE; LABORATORY EVALUATION; AND PRELIMINARY GUST WIND TUNNEL TESTS Final Summary Report [THERMOGRAPHIE PAR PHOTOLUMINESCENCE: ETUDE EN MESURE PONCTUELLE D'UN LUMINOPHORE LINEAIRE; EVALUATION EN LABORATOIRE ET PREMIERS ESSAIS EN SOUFFLERIE A RAFALE. RAPPORT DE SYNTHESE FINAL]
P. Baumann Jan. 1991 67 p In FRENCH
(Contract DRET-89-34-001)
(ONERA-RSF-128/1865-AY-726A; ETN-92-90873) Avail: NTIS HC/MF A04

A feasibility study for a thermographic process using photoluminescence in a hypersonic wind tunnel, is described. Evaluation of the thermometric potential of linear luminophores and rare earth composites is carried out outside of a wind tunnel. Initial tests in a gusting hypersonic wind tunnel are described. The tests indicate global feasibility of the technique despite perturbations due to environmental factors. The thermometric

parameter is shown to be independent of the main factors influencing photoluminescence in thermography. ESA

N92-20448# National Inst. of Standards and Technology, Gaithersburg, MD.
PROTOTYPING THE IRDS: AN AIRPORT APPLICATION
A. P. Sani Oct. 1991 119 p Sponsored in part by Erindale Coll., Mississauga, Ontario
(PB92-112580; NISTIR-4688) Avail: NTIS HC/MF A06 CSCL 14B

The management of geographic information resources (GIRS) continues to be plagued by problems of monitoring, locating, and controlling the array of geographic information in complex organizations. Software tools to support these functions are fundamental to any effort to maintain the integrity of geographic information as it changes. In addition, such tools are desirable when formalizing, then managing the integration of geographic information resources within an organization. One of the major approaches to the problem in the area of data base systems has been the development of the information resource dictionary (IRD) which contains meta-data. An Information Resource Dictionary System (IRDS) is a data base of meta-data along with software and procedures for the creation and maintenance of the IRD. In 1989, the American National Standards Institute (ANSI) X3.138-1988 IRDS (ANSI-IRDS) was adopted as Federal Information Processing Standard 156 by the U.S. Government. ANSI-IRDS is intended to support the definition, management, and control of meta-data. The first known attempt to actually apply ANSI-IRDS in the geographic information management domain is presented. Author

N92-20455# Applied Research Associates, Inc., Lakewood, CO.
RAREFACTION WAVE ELIMINATOR DESIGN STUDY Final Report, 18 Sep. 1987 - 15 Jul. 1989
Robert L. Guice, James R. Butz, and James Gottlieb (Toronto Univ., Ontario) Dec. 1991 354 p
(Contract DAAA15-87-C-0086; DA Proj. 1L1-62120-AH-25)
(AD-A244401; ARA-5462; BRL-CR-678) Avail: NTIS HC/MF A16 CSCL 14/2

Active and passive Rarefaction Wave Eliminators (RWE) were investigated for use on a small shock tube. An active RWE with rotation louvers for a modest size BRL shock tube was designed, with the open area versus time setting based on requirements from free-jet theory and the Random-Choice Method. This design yielded a device which met the operational requirements of completely closing within the 30 ms time duration of the positive phase of the simulated blast wave, and thereafter opened for the negative phase. The RWE was installed and tested at three blast wave overpressures. The results with the RWE are compared to those for both an open channel end and an extended channel on the shock tube, in order to evaluate the RWE performance. The experimental results showed that the preprogrammed theoretical area closing function was fairly accurate, especially at the lower overpressure levels. The predicted area setting is not accurate for the first few milliseconds after the shock arrives at the RWE, when the shock-induced outflow is inherently unsteady prior to the establishment of a quasi-steady jet outflow. Extrapolation of the small scale RWE design was made to the Large Blast and Thermal Simulator concept as well as the determination of preliminary costs. GRA

N92-20898# Calspan Corp., Arnold AFS, TN.
INITIAL CALIBRATION OF THE HEAT-H2 ARC-HEATED WIND TUNNEL Final Report, period ending Sep. 1990
L. M. Davis and D. B. Carver Jan. 1992 77 p Prepared for AEDC, Arnold Air Force Station, TN
(AD-A245072; AEDC-TR-91-16) Avail: NTIS HC/MF A05 CSCL 14/2

An arc-heated wind tunnel added to the test facility inventory can provide a large free-jet (up to 42 in. diameter at the nozzle exit) hypersonic flow. The tunnel, designated HEAT-H2, is capable of true temperature, true pressure simulations at speeds up to 15,000 ft/sec and altitudes up to 165,000 ft. Flow Mach numbers from 4 to 8 can be achieved with the existing nozzles. Included herein is a description of the test facility, along with initial calibration results obtained from one nozzle/throat combination. The calibration was performed using a 1.5 in. diameter throat and a 24 in. exit diameter, 8 deg half-angle conical nozzle. Arc heater chamber conditions ranged from 32 to 66 atm pressure, with total enthalpy from 1,560 to 2,160 Btu/lbm. Measurements within the free jet included distributions of pitot pressure, total enthalpy, and flow angle. Surface pressure distributions on a blunt cone were also obtained. GRA

N92-21028# Mound Lab., Miamisburg, OH.
AIR GUN TEST EVALUATION
J. J. Carleton, II, L. Fox, and C. R. Rudy 15 Jan. 1992 41 p
(Contract DE-AC04-88DP-43495)
(DE92-007268; MLM-3730) Avail: NTIS HC/MF A03

A mechanical shock testing apparatus is used for testing the response of components subject to large accelerations in hostile environments. The test acceleration is provided by the impact of a bullet against a plate on which the component to be tested is mounted. This report describes a series of experiments that were performed to determine the dependence of the air gun test apparatus performance on incremental changes in the hardware configurations, changes in the pressure used to drive the bullet, and different accelerometers. The effect of variation of these experimental factors on the measured acceleration was determined using a Taguchi screening experimental design. Experimental settings were determined that can be used to operate the tester with a measured output within acceleration specifications. DOE

12 ASTRONAUTICS (GENERAL)

For extraterrestrial exploration see *91 Lunar and Planetary Exploration.*

N92-20528*# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
MARS SAMPLE RETURN MISSION: TWO ALTERNATE SCENARIOS Final Report
25 Nov. 1991 510 p Original contains color illustrations
(Contract NASw-4435)
(NASA-CR-189970; NAS 1.26:189970) Avail: NTIS HC/MF A22; 1 functional color page CSCL 22A

Two scenarios for accomplishing a Mars Sample Return mission are presented herein. Mission A is a low cost, low mass scenario, while Mission B is a high technology, high science alternative. Mission A begins with the launch of one Titan IV rocket with a Centaur G' upper stage. The Centaur performs the trans-Mars injection burn and is then released. The payload consists of two lander packages and the Orbital Transfer Vehicle, which is responsible for supporting the landers during launch and interplanetary cruise. After descending to the surface, the landers deploy small, local rovers to collect samples. Mission B starts with 4 Titan IV launches, used to place the parts of the Planetary Transfer Vehicle (PTV) into orbit. The fourth launch payload is able to move to assemble the entire vehicle by simple docking routines. Once complete, the PTV begins a low thrust trajectory out from low Earth orbit, through interplanetary space, and into low Martian orbit. It deploys a communication satellite into a 1/2 sol orbit and then releases the lander package at 500 km altitude. The lander package contains the lander, the Mars Ascent Vehicle (MAV), two lighter than air rovers (called Aereons), and one conventional land rover. The entire package is contained with a biconic aeroshell. After release from the PTV, the lander package descends to the surface, where all three rovers are released to collect samples and map the terrain. Author

N92-20532*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-33: POSTFLIGHT EDITION

William C. Hill 15 Mar. 1990 136 p
(NASA-TM-107778; NAS 1.15:107778) Avail: NTIS HC/MF A07 CSCL 22A

Space Transportation System 33 (STS-33) safety risk factors that represent a change from previous flights, factors from previous flights that have an impact on this flight, and the factors that are not unique to this flight are discussed. While some changes to the safety risk baseline are included to highlight their significance in risk level change, the primary purpose is to insure that changes which were too late to include in formal changes through the Failure Modes and Effects Analysis/Critical Items List and Hazard Analysis process are documented along with the safety position, which includes the acceptance rationale. Author

N92-20533*# National Aeronautics and Space Administration, Washington, DC.
MISSION SAFETY EVALUATION REPORT FOR STS-35: POSTFLIGHT EDITION
William C. Hill and Seymour I. Finkel 15 Mar. 1991 203 p
(NASA-TM-107779; NAS 1.15:107779) Avail: NTIS HC/MF A10 CSCL 22A

Space Transportation System 35 (STS-35) safety risk factors that represent a change from previous flights that had an impact on this flight, and factors that were unique to this flight are discussed. While some changes to the safety risk baseline since the previous flight are included to highlight their significance in risk level change, the primary purpose is to insure that changes which were too late too include in formal changes through the Failure Modes and Effects Analysis/Critical Items List (FMEA/CIL) and Hazard Analysis process are documented along with the safety position, which includes the acceptance rationale. Author

N92-20917*# Cornell Univ., Ithaca, NY. Center for Radiophysics and Space Research.
DISCOVERY: NEAR-EARTH ASTEROID RENDEZVOUS (NEAR) Final Report
Joseph Veverka Feb. 1992 33 p
(Grant NAGw-2451)
(NASA-CR-190151; NAS 1.26:190151) Avail: NTIS HC/MF A03 CSCL 22A

The work carried out under this grant consisted of two parallel studies aimed at defining candidate missions for the initiation of the Discovery Program being considered by NASA's Solar System Exploration Division. The main study considered a Discover-class mission to a Near Earth Asteroid (NEA); the companion study considered a small telescope in Earth-orbit dedicated to ultra violet studies of solar system bodies. The results of these studies are summarized in two reports which are attached (Appendix 1 and Appendix 2). Author

N92-20925*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
REPORT OF THE NUCLEAR PROPULSION MISSION ANALYSIS, FIGURES OF MERIT SUBPANEL: QUANTIFIABLE FIGURES OF MERIT FOR NUCLEAR THERMAL PROPULSION
Davy A. Haynes Nov. 1991 11 p Prepared in cooperation with NASA, Washington; NASA. Johnson Space Center, Houston, TX; NASA. Lewis Research Center, Cleveland, OH; Idaho National Engineering Lab., Idaho Falls; PNL, Richland, WA; Phillips Lab., Edwards AFB, CA; Sandia National Labs., Albuquerque, NM
(NASA-TM-104179; NAS 1.15:104179) Avail: NTIS HC/MF A03 CSCL 22A

The results of an inquiry by the Nuclear Propulsion Mission Analysis, Figures of Merit subpanel are given. The subpanel was tasked to consider the question of what are the appropriate and quantifiable parameters to be used in the definition of an overall figure of merit (FoM) for Mars transportation system (MTS) nuclear thermal rocket engines (NTR). Such a characterization is needed to resolve the NTR engine design trades by a logical and orderly means, and to provide a meaningful method for comparison of the various NTR engine concepts. The subpanel was specifically tasked to identify the quantifiable engine parameters which would be the most significant engine factors affecting an overall FoM for a MTS and was not tasked with determining 'acceptable' or 'recommended' values for the identified parameters. In addition, the subpanel was asked not to define an overall FoM for a MTS. Thus, the selection of a specific approach, applicable weighting factors, to any interrelationships, for establishing an overall numerical FoM were considered beyond the scope of the subpanel inquiry. Author

13 ASTRODYNAMICS

Includes powered and free-flight trajectories; and orbital and launching dynamics.

No abstracts in this category.

14 GROUND SUPPORT SYSTEMS AND FACILITIES (SPACE)

Includes launch complexes, research and production facilities; ground support equipment, e.g., mobile transporters; and simulators.

For related information see also *09 Research and Support Facilities (Air).*

N92-20266*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
OPERATIONALLY EFFICIENT PROPULSION SYSTEM STUDY (OEPSS) DATA BOOK. VOLUME 4: OEPSS DESIGN CONCEPTS Final Report, 24 Apr. 1989 - 24 Apr. 1990
George S. Wong, James M. Ziese, and Shahram Farhangi 24 Apr. 1990 95 p
(Contract NAS10-11568)
(NASA-CR-188752; NAS 1.26:188752; RI/RD90-149-4-Vol-4)
Avail: NTIS HC/MF A05 CSCL 14B

This study was initiated to identify operations problems and cost drivers for current propulsion systems and to identify technology and design approaches to increase the operational efficiency and reduce operations costs for future propulsion systems. To provide readily usable data for the Advanced Launch System (ALS) program, the results of the OEPSS study have been organized into a series of OEPSS Data Books. This volume describes three propulsion concepts that will simplify the propulsion system design and significantly reduce operational requirements. The concepts include: (1) a fully integrated, booster propulsion module concept for the ALS that avoids the complex system created by using autonomous engines with numerous artificial interfaces; (2) an LOX tank aft concept which avoids potentially dangerous geysering in long LOX propellant lines; and (3) an air augmented, rocket engine nozzle afterburning propulsion concept that will significantly reduce LOX propellant requirements, reduce vehicle size and simplify ground operations and ground support equipment and facilities. Author

N92-20715# European Space Agency, Paris (France).
LAUNCH BASES AND CONTROL INFRASTRUCTURES FOR SPACECRAFT
Brigitte Kaldeich, ed. Oct. 1991 490 p In ENGLISH and FRENCH The 4th European Aerospace Conference was held in Paris, France, 13-16 May 1991
(ESA-SP-342; ISBN-92-9092-210-9; ETN-92-91203) Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

Launch bases and spacecraft control centers were addressed. Conference papers are grouped under the following headings: world launch bases; facilities for preparing and launching vehicles; facilities for preparing and integrating payloads (automatic or manned); general coordination of operations on a launch base; safety for persons and property; evolution of the measuring and

communications systems needed for launches; industrial support and logistics; control centers and station networks; placing and keeping satellites on station; tracking, measuring and monitoring during missions; ground support for rendezvous and in orbit operations; return sites and means of recovery; control of deorbiting and return to Earth; identification of space debris. For individual titles, see N92-20716 through N92-20789.

N92-20716# European Space Agency, Paris (France).
SPACE PORTS [LES PORTS DE L'ESPACE]
Jean-Marie Luton *In its* Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 7-8 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

An introductory speech to the conference on launch bases and control infrastructures for spacecraft is presented. The launch bases are described as representing the central knot of the organization which has the success of the mission as its goal. The programmatic and commercial context of future years is seen as necessary in related studies. The commercial success of the Ariane programs is summarized. Launch measures are seen as part of space commercialization and are interpreted as industrialization efforts and rationalization of firing ranges; studies of new bases in the U.S., Australia and Brazil; modernization of the Kourou launch base in French Guiana and existing U.S. bases. ESA

N92-20717# Delegation Generale de l'Armement, Paris (France).
MILITARY SPACE INTERVENTIONS [LES INFRASTRUCTURES SPATIALES MILITAIRES]
Jacques Bousquet *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 9-12 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

The military aspect of launch bases and satellite control stations is reviewed. The aim is to show the complementarity and synergy between civil installations and ballistic missile launch and test infrastructures. The (French) national context concerning military space matters is outlined. The launch bases and satellite control stations used by the army are recalled and the particular complementarities and synergies which exist between civil and military activities in these fields are discussed. ESA

N92-20718# International Telecommunications Satellite Organization, Washington, DC.
THE POLITICAL AND ECONOMICAL ASPECTS [LES ASPECTS POLITIQUES ET ECONOMIQUES]
Pierre J. Madon *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 13-15 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

Politico-economic aspects of space activity with particular focus on launch installations and spacecraft control are addressed. The acquisition of space independence as necessary for political, strategic and economic reasons is discussed. Activities of USSR, U.S., Europe, China, Japan and India are mentioned. The commercial market of telecommunication satellites and the place of INTELSAT (International Telecommunication Satellite Organization) therein are discussed. Continuation in development of launchers and launch installations of commercial space applications, recalling that space telecommunications will remain an important element and will allow every developing country progressive access to the rest of the world, is urged. ESA

N92-20719# Centre National d'Etudes Spatiales, Kourou (French Guiana).
THE GUIANAN SPACE CENTER AND ITS EVOLUTION TOWARDS THE YEAR 2000 [LE CENTRE SPATIAL GUYANAIS ET SON EVOLUTION VERS L'AN 2000]
Jean Determe *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 23-27 In FRENCH (For primary document see N92-20715 11-14)
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The origin of the CSG (French acronym for Guianan space center), the reasons which led to French Guiana as the site, missions under its responsibility and the principle bodies it comprises are outlined. The current situation considering operational and technical measures is described. Operations met, principal equipment and related limits are studied. The evolution of the CSG towards the year 2000 proceeding from decisions taken at the end of 1987 concerning space transport and orbital infrastructure is described. Practical consequences of different devices are analyzed and planned. ESA

N92-20720# Swedish Space Corp., Esrange.
ESRANGE: SOUNDING ROCKET AND BALLOON FACILITY
Ulf Hoegman, J. Englund, A. Helger, A. Wikstroem, and Lennart Marcus *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 29-31 (For primary document see N92-20715 11-14)
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Esrange (Kiruna, Sweden) offers a complete range of services for sounding rocket and balloon launchings to users from all over the world. Experiments carried out include microgravity, geophysics, space physics, astronomy and the chemistry of the upper atmosphere. Data from the extensive network of ground based scientific instruments in northern Scandinavia can be displayed at Esrange. Most types of sounding rockets including high performance vehicles such as Terrier Black Brant and Skylark 12 can be launched. The latest development, MAXUS, offers 15 minutes of microgravity and 1000 km apogee. Balloon payloads up to 500 kg are regularly flown from Esrange. The land recovery operations are very reliable concerning both rockets and balloons. ESA

N92-20721# Centro Tecnico Aerospacial, San Jose dos Campos (Brazil). Inst. de Aeronautica e Espaco.
THE BRAZILIAN LAUNCH CENTER
Tiago daSilvaRibeiro *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 33-38 (For primary document see N92-20715 11-14)
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The Brazilian launch base at Alcantra, Maranhao, is the new site for scientists to carry out experiments at equatorial latitudes and for launching missions in the north and east direction. A survey of present day status of the launch base describing the criteria of choice of the new Brazilian launch site, the facilities and the equipment, is presented. The organization and conditions for use in respect to the Brazilian launch site are presented. ESA

N92-20722# Norwegian Space Center, Oslo.
AN INTEGRATED LAUNCH FACILITY FOR SOUNDING ROCKETS AND MICRO-SATELLITES
Rolf Skatteboe *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 39-43 (For primary document see N92-20715 11-14)
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Andoya Rocket Range, the Norwegian Space Center's launch facility, established in 1962 has an extensive record of successful launches of sounding rockets. In 1989, demand for launch facilities capable of launching large sounding rockets, such as the Black Brant, was identified, and major upgrades were initiated. A new launch facility is now under construction. This pad can handle rocket configurations of up to 20 tons, offering elevation from 65 to 90 degrees and azimuth of 260 to 020 degrees. The new launch facility has been verified for use for orbital launches of microsatellites. Typically, 150 kg can be placed in polar or high

inclination orbits at an altitude of 550 km. Recent developments in satellite technology and the increasing demand for smaller satellites in dedicated orbits are making this an interesting market. A launch facility for small polar satellites is presented. Focus is on the development of a cost effective total service for launch and operation of microsatellites. A general TTC (Telemetry, Tracking and Command) station located at the island of Svalbard (Arctic) is introduced as a supplement to the Tromso Satellite Station. Special emphasis is put on describing the design of a universal launch facility for sounding rockets and microsatellites. ESA

N92-20723# Hawaii Space Development Authority, Honolulu.
SPACEPORT HAWAII: A VISION FOR THE FUTURE
George W. Mead *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 45-49 (For primary document see N92-20715 11-14)
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The growing international market for commercial launch services requires assured, low cost access to space. A variety of geographical, economic and infrastructure factors make Hawaii an ideal site for establishing a commercial spaceport, owned and operated by private enterprise, which would specialize in launching small to medium sized payloads into both equatorial and polar orbit. In light of these factors, the Hawaii Space Development Authority (HSDA) took the initiative to implement a bold and visionary plan for establishing a commercial launch facility on the island of Hawaii. The Authority's goals and activities in developing Spaceport Hawaii are discussed, highlighting the comparative advantages which make the islands a unique location from which to provide a dynamic, entrepreneurial window to space. ESA

N92-20724# Air Force Systems Command, Patrick AFB, FL.
THE UNITED STATES EASTERN TEST RANGE (ETR)
Jimmy R. Morrell *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 51-54 (For primary document see N92-20715 11-14)
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The U.S. ETR is summarized in the form of viewgraphs. The following are covered: range functions, mission support, resource locations, launch facilities, allowable launch azimuths, global command and control, worldwide tracking and orbit determination, personnel, precision tracking radar, telemetry capabilities, optics capabilities, custom data processing, meteorological support, launch history, actual launches, launch forecasts and a five year launch comparison. ESA

N92-20725# National Space Development Agency, Tokyo (Japan). Launch Operations Dept.
H-2 ROCKET LAUNCH BASE
Sumio Miida and Tomotsugu Ohnishi *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 57-61 (For primary document see N92-20715 11-14)
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With the advent of a new space era, NASDA is to launch a full scale rocket, H-2, that will be a major Japanese launch vehicle in years to come. The launch facilities for the H-2 are being installed and built in Tanegashima Space Center (TNSC). Those facilities, accommodating spacecraft launch operations, are described. Some operation outlines are shown. The content is not necessarily accurate at this point, since the project is still developing. ESA

N92-20726# Centre National d'Etudes Spatiales, Paris (France).
DESIGN EVOLUTION OF THE ARIANE LAUNCHING INSTALLATIONS [EVOLUTION DE LA CONCEPTION DES INSTALLATIONS DE LANCEMENT ARIANE]
Michel Mignot *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 63-64 In FRENCH (For primary document see N92-20715 11-14)
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The evolution of the launching assemblies for Ariane 1, 2 and 3 are described. Launching augmentation, decrease in accident vulnerability, and the search for operational activity optimization constituted the principal work axes, in parallel with a continuous adaptation to evolutions of the Ariane launcher. The Ariane 5 will benefit from one of the most modern and functional ground infrastructures. ESA

N92-20727# MATRA Espace, Toulouse (France).
ARIANE 5 GROUND CONTROL SYSTEM TESTBENCH [LA FILIERE SOL DES BANCS DE CONTROLE ARIANE 5]
Jacques-Antoine Darricau, R. Barrot, L. AmydelaBreteque, B. Schietecatte, Alain Ragot, and Philippe Caumes (Bureau Veritas, Toulouse, France) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 65-69 In FRENCH (For primary document see N92-20715 11-14)
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The ground control system testbench for the Ariane 5 launch vehicle is outlined. The portability of control ensures that tests carried out on the factory can be repeated at the time of launching. A software workshop for development and a software simulator for validation form part of the system. ESA

N92-20728# Aerospatiale, Les Mureaux (France). Div. Systemes Strategiques et Spatiaux.
IMPACTS OF THE LAUNCHERS ON THE ARIANE 4-ARIANE 5 LAUNCHING INSTALLATIONS [IMPACTS DES LANCEURS SUR LES INSTALLATIONS DE LANCEMENT ARIANE 4 - ARIANE 5]
Herve Brion and Serge Magen *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 71-78 In FRENCH (For primary document see N92-20715 11-14)
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A launcher launch assembly must include initial design constraints which optimize the performance and the availability of the launcher. In particular, the limitation of acoustic charges applied to useful charges as well as the need to include phenomena such as blast wave related to the use of large powder booster can lead to covering the flue and to water or 'flood' injections. On the other hand, the mechanical holding of the launcher at the time of different phases of its development depends on the wind and its interaction with the ground installations, which can lead to the use of specific materials like the 'wind damper'. To improve the availability, its seems useful to be able to make short term predictions of the atmosphere traversed by the launcher which will necessitate particular meteorological measurements. All this supposes major test items (reduced scale models, wind tunnel), sophisticated and costly calculation means (vibroacoustic models) a specific instrumentation of a certain number of launcher samples, and the launching assembly itself. All of these means were, and to a wide extent are still, developed to improve the performances of the Ariane 4 launcher and to define the characteristics of the Ariane 5 launcher and its launching assembly. ESA

N92-20729*# Orbital Sciences Corp., Fairfax, VA.
PEGASUS (TRADEMARK) LAUNCH OPERATIONS AND THE PEGASTAR INTEGRATED SPACECRAFT BUS
Marty Mosier, Robert Lindberg, and Keith Lyon *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 79-84 Sponsored by NASA. Goddard Space Flight Center; NASA. Hugh L. Dryden Flight Research Facility; DARPA; and Air Force Space Div. (For primary document see N92-20715 11-14)
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The Pegasus air launched space booster, which successfully flew its maiden flight on 5 Apr. 1990, provides the international satellite community with a flexible cost effective means for delivering small payloads into low Earth orbit. The vehicle's simple,

robust design and horizontal integration methods ensure maximum reliability and significantly reduce launch base infrastructure requirements. The vehicle's air launched approach and ability to launch over open ocean regions provide unmatched flexibility in launch location and approach used to ensure range safety. The PegaStar integrated spacecraft bus, which complements the Pegasus launch system, can provide a turnkey means for delivering instrument and sensor packages into low Earth orbit and providing extended (5 to 10 year) on orbit operational support. Pegasus and PegaStar are described, including payload interfaces, delivery capability; integration methods, facility and ground support equipment requirements; and typical launch operations. ESA

N92-20730# Arianespace, Evry (France). Direction Commerciale.

PAYLOAD PREPARATION ASSEMBLY (EPCU) OF KOUROU (FRENCH GUIANA) AND ARIANESPACE: THE BIGGEST EXPERIENCE IN COMMERCIAL SATELLITES [L'ENSEMBLE DE PREPARATION CHARGES UTILES (EPCU) DE KOUROU ET ARIANESPACE: LA PLUS GRANDE EXPERIENCE EN SATELLITES COMMERCIAUX]

Jean-Michel Desobeau and Pol Prigent (Centre National d'Etudes Spatiales, Kourou, French Guiana) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 87-90 In FRENCH (For primary document see N92-20715 11-14)

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For eleven years, all the preparation steps of commercial satellites for ESA, firstly, and then on behalf of Arianespace, having their launch on Ariane 1, 2, 3 and then 4, have taken place in the EPCU (French acronym for Guianan space center) at Kourou (French Guiana). The design of these installations was carried out in strict cooperation between the designer, CNES, and the users. This approach was intensified for the future Ariane 5/ELA 3 (French acronym for Ariane launch assembly), with Arianespace being the spokesperson of its clients. ESA

N92-20731# Erno Raumfahrttechnik G.m.b.H. Bremen (Germany, F.R.). Main Dept. Operations.

LAUNCH SITE OPERATIONS FOR COLUMBUS FREE FLYER AND RESUPPLY MISSION

Horst Michaelis, Klausdieter Fugel, and Harald Schmidt-Gerstmeyer *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 91-97 Previously announced as N92-12034 (For primary document see N92-20715 11-14)

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The Columbus Man Tended Free Flying (MTFF) laboratory and subsequent resupply performed by Hermes will be launched from CSG (French acronym for Guianan Space Center) with Ariane 5. Launch site operations for the initial MTFF launch includes among other transportation and receiving activities, MTFF servicing, checkout, mating of MTFF to Ariane 5 and interface verification. The operations also include a data end to end test involving the IOI GS (In Orbit Infrastructure Ground Segment) for flight operations in Europe, the DRS (Data Relay System), EET's, IGS and MSCC to verify all nominal and back up communication links and ascertain the final configuration and readiness of the involved space elements and ground facilities. The MTFF resupply missions are processed differently and follow mainly the Hermes preparation flow with integration of payload in Europe, transport to CSG, Hermes processing in the HIBK and BAF. ESA

N92-20732# Aerospatiale, Blagnac (France).

HERMES OPERATIONS IN THE KOUROU LAUNCH BASE (FRENCH GUIANA) [LES OPERATIONS HERMES SUR LA BASE DE LANCEMENT DE KOUROU]

Jean-Pierre Rouzeval *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 99-101 In FRENCH (For primary document see N92-20715 11-14)

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The Hermes operations were designed to minimize mission costs and length while assuring a coherent and complete preparation of the Hermes space vehicle, and then of the Ariane 5/Hermes combination. They were foreseen as not greatly differing from the Ariane 5/automatic payload operations. The Hermes space vehicle was designed as a recoverable vehicle launched as a passenger of the Ariane 5 launcher in order to accomplish a certain number of missions of which two were considered as tailored for the design, others requiring certain adaptations. ESA

N92-20733# Ecole Speciale d'Architecture, Paris (France).

AN ARCHITECTURAL CONCEPT FOR ASTRONAUT PREPARATION INSTALLATIONS [UN CONCEPT ARCHITECTURAL POUR LES INSTALLATIONS DE PREPARATION DES SPATIONAUTES]

Francois Lu *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 103-108 In FRENCH (For primary document see N92-20715 11-14)

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A study aimed at finding out how architectural solutions can intervene in the space field is presented. In order for the study to gather maximum information, the project is developing the programming of a spacecenter which integrates every man machine interface mechanism while endeavoring to dispel astronaut apprehension and to solidly respond to the specific needs such a space center must satisfy. The program, chosen in terms of the operation of the Ariane 5/Hermes combination, is based in French Guiana for an operational use of this system in the year 2000, when the CSG (French acronym for Guianan space center), while assuring automatic flights, will be devoted to manned flights. The architectural role is to slowly condition the astronaut to a new environment. ESA

N92-20734# MATRA Espace, Toulouse (France). Sous-Direction Integration.

SATELLITE PREPARATION OPERATIONS AT LAUNCHING [LES OPERATIONS DE PREPARATION DES SATELLITES AU LANCEMENT]

Philippe Esquivie and G. Boisbelet *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 109-112 In FRENCH (For primary document see N92-20715 11-14)

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The approach currently adopted for satellite launch phase management and possible evolutions which could lead to greater efficiency are studied. Experience acquired through numerous space projects in development and integration is described. Its appears quite realistic to simplify the launch campaign approach by reducing in-site activities of dangerous operations (ergol fueling, explosive engine installation) and of interface operations with the launcher and final launching configuration. ESA

N92-20735# Centre d'Etudes de la Navigation Aerienne, Toulouse (France).

GENERAL PRESENTATION AND OPERATIONS COORDINATION [PRESENTATION GENERALE ET COORDINATION DES OPERATIONS]

Alain Archintini *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 115-119 In FRENCH (For primary document see N92-20715 11-14)

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The CEL (French acronym for Les Landes test center (France)) carries out about 300 annual firings of missiles with very different performances and use, either within armament systems development or for armed forces training. Its day is divided into four 'crenels' with a particular measuring and safety device for each. The coordination of operations is assured in such a way that more than 85 of the 'crenels' are used despite numerous cancellations for different reasons (clients, cooperaters, weather), particularly thanks to: fast device reconfiguration possibilities; the organization of test teams; the activities programming established

by a specialist bureau in strict collaboration with those responsible for the test and the services while taking account of priority criteria defined in advance. ESA

N92-20736# Arianespace, Evry (France).
GENERAL OPERATIONS COORDINATION IN A LAUNCHING BASE: PRINCIPLES AND APPLICATION TO THE COORDINATION OF ARIANE OPERATIONS AT CSG [COORDINATION GENERALE DES OPERATIONS SUR UNE BASE DE LANCEMENT: PRINCIPE ET APPLICATION A LA COORDINATION DES OPERATIONS ARIANE AU CSG]
Roger Solari and J. Claude Legall (Centre National d'Etudes Spatiales, Kourou, French Guiana) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 121-123 In FRENCH (For primary document see N92-20715 11-14)
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The firing range concept has progressively moved towards the space port concept, true operational and logistical metropolis. The principles of launch base general operations coordination are discussed. Application to a new launch control center project at the CSG (French acronym for Guianan space center) is outlined. ESA

N92-20737# Aerospatiale, Cannes (France).
REDUCTION OF SATELLITE PREPARATION TIME AT LAUNCHING [REDUCTION DE LA DUREE DE PREPARATION DES SATELLITES AU LANCEMENT]
Bernard Hubert *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 125-129 In FRENCH (For primary document see N92-20715 11-14)
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The cost of satellite launching preparation campaign must be reduced by decreasing simultaneously the man power and the length of team campaign presence. Two approaches are described: the use of a digital link between the Aerospatiale Cannes establishment (France) and the CSG (French acronym for Guianan space center) at Kourou (French Guiana); reduction of tests carried out at CSG for verification of the state of the satellite after transport. This second approach was completely satisfactory for three successive campaigns. Its success was assured by: particular conditions for the final preparation in Europe; transport of the satellite as complete as possible; permanent limitation and knowledge of the constraints undergone by the satellite during transport. At conclusion this approach should lead to verification tests after transport no longer being carried out. ESA

N92-20738# Tokyo Univ., Sagamihara (Japan). Inst. of Space and Astronautical Science.
FLIGHT SAFETY AND GUIDANCE PROCEDURE IN KAGOSHIMA SPACE CENTRE (JAPAN)
Motoki Hinada, H. Matsuo, Y. Matogawa, Takashi Nakajima, S. Tuskamoto, Y. Maeda, and M. Kurihara (Fujitsu Ltd. Tokyo, Japan) *In* ESA Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 133-137 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

The Institute of Space and Astronautical Science (ISAS), the center of the research for space and astronautical science in Japan, has developed a series of satellite launchers called Mu series for its own missions. Since the first launch in 1971, five engineering test satellites and thirteen scientific ones, including two interplanetary ones, have been successfully launched from Kagoshima Space Center (KSC). The launch site of ISAS, KSC, is located in the southern part of Japan and, when the azimuth of the launch vehicle is set to 90 degrees measured from north, the deviation of the flight path of about 15 degrees may cause a hazardous situation, since there are very crowded areas under such a path in Japan. And, when the flight safety manager judges the necessity of the flight safety operation, the destruction command will be transmitted to the vehicle to stop its further flight. The principle of the flight safety and guidance procedure and system applied for Mu launch vehicle is presented. ESA

N92-20739# Centre d'Essais des Landes, Biscarosse (France).
NEW FLIGHT SAFETY CONCEPTS [LES NOUVEAUX CONCEPTS DE SAUVEGARDE EN VOL]
Franck Poirrier *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 139-141 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

The arrival of new types of missiles, characterized by a large maneuver potential, has led the CEL (French acronym for Les Landes test center (France)) to reconsider its preparation of decision making information for flight safety. The concept taken up, called 'Domain of possible fall to Earth', takes account of the uncertainties of the trajectography sequence and of the missile maneuver capabilities, in contrast to the former methods such as that of 'extrapolated impact point'. ESA

N92-20740# Centre National d'Etudes Spatiales, Kourou (French Guiana).
SAFETY AT THE FRENCH GUIANAN SPACE CENTER [LA SAUVEGARDE AU CENTRE SPATIAL GUYANAIS]
Henri Baccini, Didier Gaston, and Ines Gaudel *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 143-147 In FRENCH (For primary document see N92-20715 11-14)
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The safety regulations and service at the Ariane launch base are addressed. The risks at the base are mainly related to the handling of dangerous products and to inflight failures of the launcher after takeoff. During a launch campaign, one of the most dangerous phases is the chronology of launching. The development of the chronology before launching is described, showing the different 'safety' aspects: organization of operations at risk, their real time coordination, and their continuous performance. The other particularly dangerous chronological phase is that of the space vehicle flight, during which potential harmful effects must be understood and overcome. ESA

N92-20741# Centre National d'Etudes Spatiales, Toulouse (France).
LAUNCHER EXPLOSION: DETERMINATION OF THE IMPACT AREA, PROBABILITY OF IMPACT [EXPLOSION DU LANCEUR, DETERMINATION DE LA TACHE D'IMPACT, PROBABILITE D'IMPACT]
M. Rouze and F. Desclaux *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 149-155 In FRENCH (For primary document see N92-20715 11-14)
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Methods to determine the fall to Earth area of fragments and the impact probability in the case of explosion of the Ariane launcher are described. Various methods and software were developed, based on results of experimental tests to determine liquid propergol (cryogenic and hypergolic) explosion phenomena. The liberated energy characteristics of ergol explosion products, computation theory, fragment ejection speed calculation, explosion blast effect and ballistic fallback are described. The SEDIA (French acronym for explosion simulation and Ariane impact determination) code, which can correctly determine a high risk area on the ground (validation with the explosion of flight V36), is discussed. ESA

N92-20742# Centre National d'Etudes Spatiales, Toulouse (France).
GROUND SAFETY AND ITS IMPACT ON THE LAUNCHING SITE DESIGN [LA SAUVEGARDE SOL ET SON IMPACT SUR LA CONCEPTION DES INSTALLATIONS DE LANCEMENT]
Christian Tinturier *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 157-161 In

FRENCH (For primary document see N92-20715 11-14)
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The design of the Ariane launching facilities with respect to ground safety is examined through a comparison of an existing launch site (Diamond) and the design retained for a modern site (ELA3 (French acronym for Ariane Launch Assembly)). Risks presented by a launch base are discussed with the ELA3 reliability approach. Impacts on launch assembly design and on the design of a building for preparation of powder propellants are covered. ESA

N92-20743# National Space Development Agency, Tokyo (Japan).
FLIGHT SAFETY SYSTEMS FOR THE H-2 LAUNCH VEHICLES
Hidehiko Mori, S. Ishida, and T. Sato *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 163-168 (For primary document see N92-20715 11-14)
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The H-2 rocket, Japan's new expandable launch vehicle, is under development by NASDA (National Space Development Agency of Japan) and is to be operational in 1993. The fundamental policies of flight safety practiced by NASDA and newly developed flight safety systems for the H-2 rocket are described. Due to limited land space in Japan, the flight safety immediately following the liftoff is a very important consideration. Launch site, RCC (Range Control Center) and other facilities are being built in new locations. In addition, construction of the flight safety systems for the H-2 rocket is taking place. Computers and displays are being renewed for flight safety observation systems. Communication systems are also being reconstructed using optical local area network system. ESA

N92-20744# Direction des Missiles et de l'Espace, Brest (France). Groupe Naval d'Essais et de Mesures.
RECEPTACLE FUNCTION: FROM THE HENRI POINCARE TEST AND MEASUREMENT SHIP TO THE MONGE TEST AND MEASUREMENT SHIP [LA FONCTION RECEPTACLE: DU BATIMENT D'ESSAIS ET DE MESURES 'HENRI POINCARE' AU BATIMENT D'ESSAIS ET DE MESURES 'MONGE']
Yves Tanguy *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 171-175 In FRENCH (For primary document see N92-20715 11-14)
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The Henry Poincare receptacle ship created at the same time as the CEL (French acronym for Les Landes test center (France)) for reception and acquisition of measurements during the final phase of ballistic missile flights, is described. The evolution of more powerful means to respond to future missile measurements is discussed. The Monge will be the new measuring ship and will be equipped, from 1992, with a general device for performance measuring, including radar, telemeasurement means, optics, and a meteo-aerology station. ESA

N92-20745# Centre National d'Etudes Spatiales, Kourou (French Guiana). Centre Spatial Guyanais.
MEASUREMENTS AND TELECOMMUNICATIONS SYSTEM OF THE GUIANA SPACE CENTER AND ITS EVOLUTIONS TO HORIZON 2000 [LE SYSTEME DE MESURES ET DE TELECOMMUNICATIONS DU CENTRE SPATIAL GUYANAIS ET SES EVOLUTIONS A L'HORIZON 2000]
Philippe Noel *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 177-186 In FRENCH (For primary document see N92-20715 11-14)
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The measurement and telecommunications system at CSG (French acronym for Guianan space center), currently adapted for Ariane 4 missions, is described. Adaptations to be undergone in order to satisfy, in particular, the Ariane 5 missions are outlined. The impacts of Ariane 5/Hermes are covered. The positioning and acquisition and processing chains and the telemeasurement transmission network are illustrated. ESA

N92-20746# Centre National de la Recherche Scientifique, Verrieres-Le Buisson (France). Service d'Aeronomie.
A DOPPLER RAYLEIGH LIDAR FOR MEASURING WINDS IN THE MIDDLE ATMOSPHERE
A. Garnier and M. L. Chanin *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 187-189 (For primary document see N92-20715 11-14)
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A better understanding of the interaction between the waves and the background wind in the altitude range 25 to 65 km, where there is still no possibility to adequately monitor the wind field, led to the development of a new Doppler lidar designed to cover this height range, and therefore it had to rely on Rayleigh scattering from air molecules. The possibility of measuring mean winds in the middle atmosphere with this new Doppler lidar was demonstrated. Its extension down to the tropopause is under study. ESA

N92-20747# Regulus S.A., Kourou (French Guiana).
PROPERGOL PRODUCTION IN A LAUNCHING BASE (UPG) [LA PRODUCTION DE PROPERGOL SUR UNE BASE DE LANCEMENT (L'UPG)]
Remy Favrot *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 193-197 In FRENCH (For primary document see N92-20715 11-14)
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The UPG (French acronym for Guiana propergol factory), built in French Guiana in order to avoid transportation of charged sections within Europe and between Europe and Guiana, is described. The factory was designed to specificallly construct 100 ton sections of 3 m diameter. These are treated vertically, in preflight position, during the whole manufacturing and are moved about within most of the buildings by air cushions. For safety reasons, the buildings are distributed over 300 hectares, and handling is optimized with the management software system and input/processing software to ensure quality. ESA

N92-20748# Erno Raumfahrttechnik G.m.b.H. Bremen (Germany, F.R.).
COLUMBUS FREE FLYING LABORATORY (MTFF) LOGISTICS, TRANSPORTATION, AND GROUND PROCESSING
Mike C. Attwood, Manfred Nordhoff, and Horst Goerlich *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 199-212 Previously announced as N92-12589 (For primary document see N92-20715 11-14)
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Columbus Man Tended Free Flying laboratory (MTFF) requires the implementation of an integration logistics support system in order to ensure the supportability of the MTFF throughout its operational life of 30 years. MTFF handling and transportation of the MTFF to the launch site in configuration as close as possible to the launch configuration presents a challenge to transportation methods and scenarios, and requires an innovative infrastructure. Ground processing and checkout activities at the Guiana space center launch site need to be organized and timelined in a way to have existing launch site facilities and capabilities support the MTFF needs, and to meet the scheduled launch date. ESA

N92-20749# European Space Agency. Centre Spatial de Toulouse (France). Hermes Joint Team.
INTEGRATED LOGISTICS SUPPORT (ILS) FOR THE HERMES SYSTEM
Juergen Pfennigstorf and D. Berthelot (MATRA Espace, Toulouse, France) *In its* Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 213-218 (For primary document see

N92-20715 11-14)
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The main idea of ILS is to introduce supportability requirements, contraints and criteria for a complex technical system early in the design definition phase in order to achieve a readily supportable system at affordable life cycle costs. This technique, developed and used in the U.S., mostly in military programs, was only recently introduced in European space programs. The general approach to ILS, and how it can or should be applied to the Hermes system is described. The unique characteristics of this system in terms of prototype production, multinational and multiprogram participation, and development and operational site dispersion, necessitate adaptation of the U.S. standards to this environment. The conclusion is that no new engineering discipline or organizational entities are to be created, but special management techniques are to be applied to integrate logistics with all other system development activities. ESA

N92-20750# L'Air Liquide, Paris (France).
UNITY OF LIQUID HYDROGEN PRODUCTION [L'UNITE DE PRODUCTION D'HYDROGENE LIQUIDE]
Alain Houdart *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 219-222 In FRENCH (For primary document see N92-20715 11-14)
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The liquid hydrogen production environment in French Guiana is analyzed. Choices made are discussed and the production factory, technological evolutions and future perspectives are described. Requirements for liquid hydrogen supplying in Guinana are considered with a comparison between Ariane 4/Ariane 5 needs. The liquid hydrogen factory at Kourou is described. ESA

N92-20751# Eutelsat, Paris (France).
THE GROUND CONTROL SYSTEM OF EUTELSAT 2
G. Payet and Manuel Calvo *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 227-230 (For primary document see N92-20715 11-14)
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The main features of the satellite control system implemented for the control of Eutelsat second generation satellites are presented. This control system includes a Satellite Control Centre (SCC) and two Telemetry, Command and Ranging (TCR) stations, with a backup SCC located at one of the stations. The modern architecture of the SCC offers a wide range of functions easily accessible and a highly flexible user interface. In this way, ground control network monitoring and orbital operations can be performed in an efficient way and with a high degree of security. ESA

N92-20752# Xian Satellite Control Center (China). System Engineering Section.
INTRODUCTION TO XIAN SATELLITE CONTROL CENTRE (CHINA)
Gezhilong and Shi Xusheng *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 231-234 (For primary document see N92-20715 11-14)
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The constitution of XSCC (Xi'an Satellite Control Center), the technology facilities of the control center and its TTC (Telemetry, Tracking and Command) stations as well as the TTC and management capability of the network, are described. XSCC is located in Xi'an city (China). ESA

N92-20753# Centre National d'Etudes Spatiales, Toulouse (France).
KERGUELEN ISLANDS TRACKING STATION [LA STATION DE POURSUITE DES ILES KERGUELEN]
Michel Starozinski *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 235-240 In FRENCH (For primary document see N92-20715 11-14)
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The S band tracking stations, an extension of the 2 GHz network, on the Kerguelen Island is addressed. Technical innovations with relation to other stations are summarized. Emphasis is given to consequences in the development and exploitation of meteorological constraints (frequent winds which can be nearly 300 km/h) and isolation constraints (rare and solely sea transport). ESA

N92-20754# Centre National d'Etudes Spatiales, Toulouse (France).
SPOT CONTROL AND MISSION CENTER [LE CENTRE DE CONTROLE ET DE MISSION SPOT]
Pierre Tomiak *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 241-246 In FRENCH (For primary document see N92-20715 11-14)
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The control and mission center for the SPOT 1 and 2 satellites is detailed. The method adopted to take account of constraints imposed by the satellites is described. The surveillance and programming of SPOT 1 and 2 have proven to be efficient and reliable, with not one day lost because of ground segment breakdown since launchers. The structure is maintained for the SPOT 3 program. ESA

N92-20755# Centre National d'Etudes Spatiales, Toulouse (France). Direction du Programme Hermes.
HERMES FLIGHT CONTROL CENTER [LE CENTRE DE CONTROLE EN VOL HERMES]
Dominique Zobler, Jean-Paul Abadie, and Serge Sampoux (Societe Anonyme de Telecommunications, Labege, France) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 247-255 In FRENCH (For primary document see N92-20715 11-14)
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The Hermes Manned Spaceplane Flight Control Center will be situated in Toulouse (France) and for each Hermes Mission will ensure the following: crew operational support for execution of onboard operations; spaceplane and subsystems surveillance control; and ground coordination for flight execution. A profile of the mission is given. Control center functions and the inflight control center architecture are outlined. ESA

N92-20756# MATRA Espace, Toulouse (France).
DATA PROCESSING SYSTEM FOR EUROPEAN MANNED SPACE FLIGHT CONTROL CENTRES
Daniel Herlemont and G. Mace *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 257-263 (For primary document see N92-20715 11-14)
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The Data Processing System (DPS) for the IOI (In Orbit Infrastructure) Ground Segment (GS) is presented. An overview of the generic DPS architectuire is given. The DPS architecture proposes guidelines to the various control centers of the IOI mainly: the central mission control center; the manned Space Laboratory control center for Columbus; the Hermes Flight Control Center. This architecture was used to estimate savings in the development of those facilities. This common approach is a key design factor that contributes to service in terms of operational efficiency and cost savings. ESA

N92-20757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
SPACE MISSION SUPPORT BY NASA SPACE NETWORK
Robert Godfrey *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 265-270 (For primary document see N92-20715 11-14)

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Normal NASA operational considerations and Phase 1 of Space Network (SN) interoperability foresees S band cross support between user spacecraft and space networks or partnering agencies. A typical interoperable scenario for an S band user spacecraft of a partner space agency with the NASA SN is presented. ESA's Hermes Manned Spaceplane exemplifies a typical interoperable user. In order to demonstrate the support potential of the NASA SN, the internal and external interfaces of the TDRSS (Tracking and Data Relay Satellite System), ATDRSS (Advanced TDRSS), and supporting elements are examined. Communications and operational requirements for a typical mission supported by the NASA SN are discussed. ESA

N92-20758# European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).

ESA'S LAUNCH AND EARLY ORBIT SUPPORT FACILITIES

A. Smith and Pierre Kaufeler *In its* Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 271-277 (For primary document see N92-20715 11-14)

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Since ESRO-2 was launched in May 1967, which was the first mission supported by the European Space Operations Center (ESOC), more than 30 missions have been controlled to date from the Operations Control Center, located at Darmstadt, Fed. Republic of Germany. One common feature of these diverse missions has been the approach ESOC has adopted for the Launch and Early Orbit Phase (LEOP). This phase is normally the most critical. For this reason ESOC uses a common infrastructure for all LEOP's and transfers to dedicated mission specific facilities only after the routine phase has been declared. The LEOP ground segment, which has been in place in its current configuration since the mid 1980's, comprises standard multimission facilities, thus reducing the effort and cost required for the preparation of a new mission. ESA

N92-20759# Telespazio, S.p.A., Rome (Italy).

A DISTRIBUTED OPERATIONAL CONTROL SYSTEM FOR THE ITALSAT MISSION

M. Manca and A. Nardella (Dataspazio S.p.A., Rome, Italy) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 279-283 (For primary document see N92-20715 11-14)

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A satellite Operational Control Center (OCC) based on a distributed hardware/software architecture with a high degree of availability is described. The system is currently installed at Fucino (Italy) as part of the ground segment for the Italsat (Italian Telecommunications Satellite) mission control and operation. Italsat was successfully launched on 15 Jan. 1991. The OCC design features include: built-in capacity to extend the control to an additional in orbit satellite (Italsat 2), by hardware upgrading only; and graceful degradation in response to multiple failures. ESA

N92-20760# European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.). Orbit and Attitude Div.

THE FLIGHT DYNAMICS SUPPORT TO ESA MISSIONS

J. Fertig and Rolf E. Muench *In its* Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 287-295 (For primary document see N92-20715 11-14)

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Flight dynamics support deals with the estimation and control of the orbit and attitude of spacecraft. Those missions which provided the most prominent challenges to ESA's flight dynamics experts from 1968 to date are highlighted. In meeting challenges, ESA's ground support subsystems (computer hardware and software) were instrumental. In order to meet future flight dynamics challenges, the ESA's Orbit Attitude Operations Systems (ORATOS) were conceived. The ORATOS design outlined will profit from ESOC's many years of operational flight dynamics experience. ESA

N92-20761# Centre National d'Etudes Spatiales, Toulouse (France).

POSITIONING OF GEOSTATIONARY SATELLITES AT CNES: OPERATIONAL GROUND FACILITIES, ORGANIZATION, AND DOCUMENTATION [MISE A POSTE DES SATELLITES GEOSTATIONNAIRES AU CNES: MOYENS SOL, ORGANISATION ET DOCUMENTATION OPERATIONNELLES]

Herve Donat *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 297-302 In FRENCH (For primary document see N92-20715 11-14)

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Facilities of the French Space Agency for the positioning of geostationary satellites are described. The organization and documentation used demonstrate the rigorousness with which these facilties are performed. The different TTC (Telemetry, Tracking, and Control) networks which can be used for the positioning of geostationary satellites are presented. ESA

N92-20762# Centre National d'Etudes Spatiales, Toulouse (France).

INMARSAT-2/F1 POSITIONING [MISE A POSTE INMARSAT-2/F1]

Genevieve Campan *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 303-313 In FRENCH (For primary document see N92-20715 11-14)

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The first of four Inmarsat 2 telecommunication satellites was successfully launched on 30 Oct. 1990 by the U.S. Delta 2 rocket, which placed the satellite in geostationary transfer orbit after launch from Cape Canaveral (Florida, U.S.). The space center at Toulouse (France) then took control of operations, putting the satellite into the orbit test, and from there to its delivery orbit above the Indian Ocean, using a subsystem of the ground system, the SDM (French acronym for determination and maneuver service). Important aspects of the mission in terms of the space mechanics, the means used to resolve them, and some in flight results are presented. ESA

N92-20763# MATRA Espace, Toulouse (France). Operations and Artificial Intelligence Div.

ON AN OPERATIONAL EXPERT SYSTEM FOR THE TELECOM 2 SATELLITE CONTROL CENTRE

L. Valluy, P. Caloud, Philippe Pham, and Jean-Claude Maurize (Centre National d'Etudes Spatiales, Toulouse, France) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 315-320 (For primary document see N92-20715 11-14)

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The design process of an operational expert system for satellite fault isolation is described. This expert system will be delivered to the French Telecom 2 Satellite Control Center in 1992. Strong emphasis is given to its operational background and requirements on the one hand, and of the nature of its models of expertise on the other hand. The context and mission of the expert system, that was assessed by the development and experimentation of a prototype, are analyzed. The way the conception and operational knowledge is modeled is addressed. Further applications of the expert system are discussed. ESA

N92-20764# International Telecommunications Satellite Organization, Washington, DC.

SATELLITE DIAGNOSTICS SYSTEM: AN EXPERT SYSTEM FOR INTELSAT SATELLITE OPERATIONS

C. P. Chang, W. Nallo, R. Rastogi, Dana Beugless, F. Mickey, and Alvin Shoop (Expert Systems Consulting Group, New York, NY.) *In* ESA, Launch Bases and Control Infrastructures for

Spacecraft Oct. 1991 p 321-327 (For primary document see N92-20715 11-14)
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An ability to monitor, diagnose, and respond to anomalies in real time in the attitude control subsystem is critical for long term, uninterrupted satellite communication service. INTELSAT (International Telecommunications Satellite Organization) is developing an expert system for satellite operations. Innovative use of two techniques, model based reasoning and probabilistic fault determination, is described. The goals of the system are to minimize attitude disturbances, and recovery time, reduce communication outages and increase the satellite system availability. ESA

N92-20765# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.). Space Operations Center.
SOFTWARE FOR STATION KEEPING OF CO-LOCATED GEOSTATIONARY SATELLITES **c61**
Alfred Pietrass, M. C. Eckstein, and O. Montenbruck *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 329-335 (For primary document see N92-20715 11-14)
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A compact but powerful and accurate software system for station keeping of single and co-located satellites which is currently being integrated at the German Space Operations Center is described. Core modules are orbit determination, including maneuver estimation, maneuver planning, ephemeris, interference and event prediction, and relative motion for co-located satellites. A compact orbit and maneuver data base is maintained and accessed by the different modules. The user interface is realized as a menu driven shell using alphanumeric screen masks. The software is written in Ada and FORTRAN and will be implemented under the Digital Equipment VMS. It may be run on a workstation or accessed through alpha terminals. External users are invited to license this software. ESA

N92-20766# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.). Space Operations Center.
THE DLR-GSOC LAUNCH WINDOW SOFTWARE **c61**
Reinhard Kiehling *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 337-342 (For primary document see N92-20715 11-14)
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A Launch Window (LAUWIN) program was developed for multiburn geostationary transfer missions. In the present version, the program processes the following types of contraints for the launch window: forbidden Earth or Moon shadows; maximum duration of Earth or Moon shadows; forbidden Sun aspect angles within a satellite coordinate system; forbidden Earth/Moon interference during Earth acquisition scans; forbidden Sun colinearities (angles Sun-Earth-satellite); and forbidden Earth-satellite-Moon angles. ESA

N92-20767# Centre National d'Etudes Spatiales, Toulouse (France).
PLACEMENT OF THE TURN AROUND POSITIONING SYSTEM FOR THE TELECOM 1 SATELLITES [MISE EN PLACE DU SYSTEME DE LOCALISATION PAR 'TURN AROUND' POUR LES SATELLITES TELECOM 1]
Jean-Pierre Pochon, Claire Fremeaux, and Monique Moury *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 345-349 In FRENCH (For primary document see N92-20715 11-14)
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The evolutions and validation of a positioning concept called 'turn around' for the French telecommunication satellite system Telecom 1 are described. This concept replaces the preceding one associated with angular measurement of distance. Its global placement required a transmit/receive station joined with a telesurveillance system and the evolution of three existing control stations and the measurement preprocessing software on the control center computers. The system qualification results are satisfactory. The restored orbits are closely accurate to those obtained with the reference network. ESA

N92-20768# Xian Satellite Control Center (China).
TELEMETRY MONITOR (TMM) STATION ON SATELLITE STATION-KEEPING PHASE
Shi Xusheng, Jiang Jiachi, and Wang Yujun *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 351-354 (For primary document see N92-20715 11-14)
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In Chinese ground TTC (Telemetry, Tracking, and Control) systems for communication satellites, a unique conception of Telemetry Monitor (TMM) station was adopted. Under arrangement of the Xi'an Satellite Control Center (XSCC) (China), the system used two C band full motion antenna stations (one is used for backup and alternative) to perform TTC during transfer orbit and synchronous orbit phase. Several TMM stations were used to monitor telemetry from several Chinese communication satellites, instead of using limited motion antenna stations. Application of TMM is concluded to be a successful practice based on Chinese conditions. ESA

N92-20769# European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.). Operations Dept.
GIOTTO REACTIVATION OPERATIONS IN 1990
Antonello Morani and H. R. Nye *In its* Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 355-360 (For primary document see N92-20715 11-14)
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The main features of the reactivation and successful recovery of the ESA probe Giotto in Feb. 1990 are described. After four years of hibernation, contact with the spacecraft was re-established at 100 million km (0.68 AU) from the Earth, requiring both recovery from onboard failures and maneuvering without receiving telemetry. The use of NASA deep space network with 70 m antennas for high power uplink and downlink reception of an unmodulated RF carrier and the damage sustained by Giotto during the encounter with Halley were instrumental in the successful operations. ESA

N92-20770# Erno Raumfahrttechnik G.m.b.H. Bremen (Germany, F.R.).
GROUND SEGMENTS FOR MISSION CONTROL AND OPERATION OF EURECA
F. Schwan and J. Dettmer (Messerschmitt-Boelkow-Blohm G.m.b.H., Bremen, Germany, F.R.) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 363-369 (For primary document see N92-20715 11-14)
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EURECA represents a free flying, multipurpose, reusable space platform. Complementary to the complex onboard system new and challenging requirements were also put on the ground segments, on their concepts, and architectures. Ground and flight control are essentially driven by the large number of experiments to be monitored and controlled, the long mission duration, and the extremely limited periods of ground contacts. The ESOC flight operation control center has taken prime responsibility to guide the EURECA system through all phases of the mission, including the deployment and retrieval interactions with NASA Space Shuttle. ESA

N92-20771# European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
GROUND SUPPORT TO IN-ORBIT SERVICING OPERATIONS

M. Guerin *In its* Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 371-378 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

ESA's plan concerning the ground support to in orbit servicing of the Columbus Man Tended Free Flyer by the Hermes Manned Spaceplane are presented. The operations which are concerned are: the rendezvous and docking; the external servicing, by means of telemanipulation and/or EVA (Extravehicular Activity); and the internal servicing operations. Focus is on the facilities foreseen to provide engineering support during equipment development and validation, mission preparation and training, mission execution, and postflight analysis. The concept is based on a gradual transition of simulation facilities and expertise from the development phase to the operations phase. ESA

N92-20772# Aerospatiale, Les Mureaux (France). Dept. Controle du Vol.
GROUND CONTROL FOR THE HERMES-MTFF: APPLICATION OF THE MISSION ANALYSIS METHODS DEVELOPED AT AEROSPATIALE [CONTROLE SOL POUR LE RENDEZ-VOUS HERMES-MTFF: APPLICATIONS DES METHODES D'ANALYSE DE MISSION DEVELOPPEES A AEROSPATIALE]
Gilles Mortal, Franck Martel, and Helmut Luttmann (Erno Raumfahrttechnik G.m.b.H. Bremen, Germany, F.R.) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 379-384 In FRENCH (For primary document see N92-20715 11-14)
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The increasing complexity of space mission entails increased support of flight control centers; the latter have to coordinate vehicle activity and observation means, while managing possible conflicts of authority or possible failures. Onboard systems evaluating the good passing of the mission, its planning, or under various operational constraints its replanning, falls to one of the ground control centers. Simple sequencing no longer answers such requirements. An evolving mission plan execution tool is proposed, using as an illustration example the orbital rendezvous between Hermes and the Columbus MTFF (Man Tended Free Flyer). ESA

N92-20773# Centre National d'Etudes Spatiales, Toulouse (France). Direction du Programme.
HERMES: HERMES SPACEPLANE RETURN SITES [HERMES: LES SITES DE RETOUR DE L'AVION SPATIAL HERMES]
Bernard Houze and Bruno Belon *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 387-392 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

The Hermes Manned Spaceplane is a hypersonic glider equipped with a certain maneuver capability which allows it to rejoin, predetermined launching sites at the end of its orbital mission. The determination of these sites takes into account the following criteria: economic, existing infrastructure, space mechanics deciding the reentry conditions and opportunities, resource module fall to Earth, availability of potential terrestrial sites, and safeguards during the launch phase. The functions and installations of the return site are more or less complete concerning nominal sites, orbital assist sites and launch assist sites. ESA

N92-20774# Centre National d'Etudes Spatiales, Toulouse (France). Direction du Programme.
HERMES: ASTRONAUT SAFETY DURING LAUNCHING AND REENTRY PHASES [HERMES: SAUVEGARDE DES SPATIONAUTES PENDANT LES PHASES DE LANCEMENT ET DE RENTREE]
Jean Charles *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 393-396 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

The Hermes Manned Spaceplane serves as a shuttle between the Earth and the Columbus Space Station for a crew of three astronauts. The Hermes spaceplane 'concept' incorporates a crew safety logic that determines risks during the critical phases of launch and reentry. The crew safety logic is a function of the possible emergencies, the timing of those emergencies, and the predicted outcome of the emergencies. The possible outcomes are as follows: complete loss, saving of crew with loss of plane, or saving of crew and plane with loss of mission. ESA

N92-20775# Aerospatiale, Les Mureaux (France). Div. Strategiques et Systemes Spatiaux.
AUTOMATIC EUROPEAN CAPSULES: WHICH RETURN SITES? [CAPSULES EUROPEENNES AUTOMATIQUES: QUELS SITES DE RETOUR?]
Marie-H. Aenishanslin and Anne Tomatis *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 397-402 In FRENCH (For primary document see N92-20715 11-14)
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The return opportunites, in a European, land or sea framework, for automatic unmanned capsules can be reduced or constrained according to the mission orbit requirements and the available recovery sites. A multisite strategy often proves to be necessary. Characteristics of European recovery capsules are outlined. The types of constraints influencing recovery zone choice are described. Recovery cost minimization, with regard to trajectory type, is discussed. ESA

N92-20776# Booz-Allen and Hamilton, Inc., Houston, TX. Space Systems Div.
ATTRIBUTES OF WINGED MANNED SPACE VEHICLES AND THEIR RELATIONSHIP TO GROUND SITE CHARACTERISTICS AND FACILITIES
Karol J. Bobko *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 403-408 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

The task of safely landing a winged space vehicle and returning it to the processing facility is a demanding and complicated process. Unconventional ground facilities are required because of the characteristics of this vehicle type. The approach trajectory dictated by the high speed gliding flight requires special runway outfitting. The Space Shuttle and Hermes have a similar approach and landing trajectory. The one used by the Space Shuttle is described. The systems designed to operate in space require special support on the ground. The preparation of the spacecraft and the ferry flight back to the processing facility take special equipment and trained personnel. All of these items must be planned to ensure that the landing and subsequent activities are safe and efficient. ESA

N92-20777# Centre National d'Etudes Spatiales, Toulouse (France).
HERMES SPACEPLANE DEORBITATION AND PROBLEMS RELATED TO THE FALLDOWN OF ITS RESOURCE MODULE [DESORBITATION DU VEHICULE SPATIAL HERMES ET PROBLEMES LIES A LA RETOMBEE DE SON MODULE DE RESSOURCE]
Jerome Legenne, C. Aubert, R. Broca, and J.-F. Goester *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 411-417 In FRENCH; ENGLISH summary (For primary document see N92-20715 11-14)
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Hermes recoverable vehicle reentry problems are addressed. The deorbitation maneuver is described, and the landing site network is presented. Additionally, Hermes Resource Module falldown is discussed. ESA

N92-20778# Aerospatiale, Les Mureaux (France). Div. Systemes Strategiques et Spatiaux.
CONTROL OF THE DESTRUCTION OF A LOGISTIC VEHICLE AT REENTRY [CONTROLE DE LA DESTRUCTION D'UN VEHICULE LOGISTIQUE A LA RENTREE]
Regis Thevenot *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 419-424 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

Research was undertaken to better understand and control the return to Earth of a launch stage. The stage reenters the atmosphere, at high Mach number, after a 'ballistic' flight of variable length. In order to model the behavior of this object during its return to Earth, specific studies were necessary in the following areas: aerodynamic characterization of the stage in its complete flight domain; clarification of possible equilibrium positions; and reentry trajectory calculations to define a scenario which eliminates lift problems. The approach will be completed by elements which take into account the break-up of the stage and the resulting debris. ESA

N92-20779# European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.). Mission Analysis Section.
OVERVIEW ON EUROPEAN ACTIVITIES ON SPACE DEBRIS **c18**
Walter Flury *In its* Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 427-432 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

Space debris is a growing threat to manned and unmanned space activities. It is a global issue, which affects all users of space. As the risk posed by space debris reaches a level which requires serious considerations and measures, especially for manned missions, ESA, together with its memberstates, has inititiated steps to better understand and mitigate the problem. European efforts to address the issue of space debris are described. Three main areas are discussed: improved knowledge of the terrestrial particulate environment, including the future evolution of the space debris population; assessment of the risk for manned and unmanned space missions; and protective and preventive measures. The seriousness of the problem is such that measures to reduce the growth of space debris should be initiated now. ESA

N92-20780# Technische Univ., Brunswick (Germany, F.R.). Inst. for Spaceflight and Nuclear Reactor Technology.
CLOSING THE DATA GAP OF SPACE DEBRIS: GROUND BASED OR SPACE BASED SENSORS? **c18**
Peter Eichler, J. Bendisch, and J. Zhang *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 433-438 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

The increasing risk of collision with man-made orbital debris is a threat to all spaceflight activities. Due to the very high velocities, on the order of 10 km/s, occurring in such collisions, even mm sized particles can penetrate the outer walls of a spacecraft. Currently, only the orbits of objects larger than 10 cm were determined by ground based measurements. Only sporadic measurements in the cm size range were performed. Hence, there is a data gap in the critical size range of the cm and mm population. Deterministic data on the cm size population, and better statistical data on the mm sized population are urgently needed to enable more detailed analysis of the collision risk and possible countermeasures, e.g., shielding and collision warning and avoidance for the Space Station. The potential contributions of the different kinds of sensors (ground based or space based) are discussed. ESA

N92-20781*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
TECHNIQUES FOR DEBRIS MITIGATION **c18**
Joseph P. Loftus, Jr. *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 439-446 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

Techniques for space debris abatement and removal are discussed. Characteristics of the total debris population and the low Earth orbit population are illustrated. Self disposal options that utilize propulsion maneuvers and drag augmentation devices are described. The active retrieval and disposition of large debris objects by collection with a maneuverable space vehicle are discussed. The removal of small debris by using a solar reflector to melt particles or by destruction with high energy laser devices is discussed. ESA

N92-20782*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
RADAR MEASUREMENTS OF THE ORBITAL DEBRIS ENVIRONMENT **c18**
Eugene G. Stansbery and Carl C. Pitts (XonTech, Inc., Los Angeles, CA.) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 447-452 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders CSCL 22B

The collection and preliminary processing of the first significant accumulation of orbital debris data collected by the Haystack radar is described. The data are collected in the 'beam park' mode of operation in which the radar stares in a fixed direction and debris randomly passes through the field of view. Haystack's processing system performed automatic real-time processing and threshold detection, and saved only data associated with a possible detection. Approximately 123 hours of data were collected with the radar beam parked at an elevation angle of 10 deg and an azimuth of 180 deg; 3.8 hours were collected at an elevation angle of 30 deg and an azimuth of 180 deg; and 33.9 hours were collected at an elevation angle of 90 deg. A computer model of the response of the Haystack radar while in beam park operation is described. The model calculates the probability of detection and collection area for all sizes and orbital inclinations of debris visible to the radar. At this time, the approximate sizes of the detected objects have not been determined. However, the observed detection rates and cumulative signal to noise ratio distributions agree well with the results of the radar response model using NASA's current orbital debris environment. ESA

N92-20783# Dassault Espace, Saint-Cloud (France).
QUALITY AND SAFETY OF OPERATION: REVIEW OF EXPERIENCE [QUALITE ET SURETE DE FONCTIONNEMENT: LE RETOUR D'EXPERIENCE] **c66**
Jean-Gerard Roussel *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 455-457 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

A personal outlook on the review of experience, which is defined to be the gathering, processing, and disposal of data and the effective use of results by those who are in a position to ensure progress, is presented. Resistance to change and setback of development are discussed. Principles outlined in a study of quality progress are cited: discerning the need to change; change must be voluntary; the process of change must be based on principles; the process of change must be eased by others having the same approach; and change must be conducted in steps. ESA

N92-20784# Centre National d'Etudes Spatiales, Paris (France).
IN-ORBIT LAUNCHES AND OPERATIONS: TOWARDS AN OPTIMIZED MANAGEMENT OF MEDIA EVENTS [LANCEMENTS ET OPERATIONS EN ORBITE: VERS UNE GESTION OPTIMISEE DES EVENEMENTS MEDIATIQUES] **c80**

L. Laidet *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 459-466 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

A personal outlook on the use of communication management to optimize media coverage of space activities is presented. Informative communication, communication relating to events, communication in crises, educational and pedagogical communication, and ludic and imaginative communication, are discussed. Communication on launch and orbital operations is described. The importance of space activities as a means through which lessons in cooperative communication are learned is stressed. ESA

N92-20785*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
AN OUTLOOK FOR THE TWENTY FIRST CENTURY AS TO LAUNCH OPERATIONS, FACILITIES, AND SYSTEMS **c66**

Joseph P. Loftus, Jr. *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 467-474 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

A discussion of launch systems for the 21st century is presented. The following launch systems are mentioned: the European Ariane family; the Japanese H-1 and H-2; the U.S.'s Titan, Delta, Atlas, and Space Shuttle; the Chinese Long March 4; and the USSR's Mir, Proton, and Zenit. Systems currently under investigation, including the Assured Crew Return Vehicle, Personnel Launch Systems, and Single Stage to Orbit (SSTO), are discussed. Automated operations, low Earth orbit, and reliability are addressed. Standards that were acceptable for ballistic missiles will not be acceptable for future launch vehicles. The achievement of significantly higher levels of reliability is seen as the challenge. ESA

N92-20786# Bureau Veritas, Toulouse (France).
OPERATIONAL SAFETY OF A KOUROU (FRENCH GUIANA) ARIANE LAUNCH BASE GROUND SYSTEM [SURETE DE FONCTIONNEMENT D'UN SYSTEME SOL DE LA BASE DE LANCEMENT ARIANE DE KOUROU]

Philippe Caumes, Alain Ragot, and B. Schietecatte (MATRA Espace, Toulouse, France) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 483-486 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

The methodology and results of evaluation studies of the operational safety of the Ariane 5 operational control center are presented. The performance of this system in terms of reliability, availability, and security are analyzed. It is determined that the operational safety activities must guarantee the attainment and maintenance of the necessary level through the identification, evaluation, hierarchization, reduction, and acceptance of risks. ESA

N92-20787# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INPE'S SATELLITE TRACKING AND CONTROL CENTER: PRESENT STATUS AND PLANS FOR FUTURE

P. Rozenfeld *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 487-489 (For primary document see N92-20715 11-14)
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In order to monitor and control its satellites in orbit, the Brazilian National Institute for Space Research (INPE) has established a system of ground facilities. This system is called the Satellite Tracking and Control Center (CRC). CRC is composed of a Satellite Control Center (CCS), which is located on Sao Jose dos Campos, and two ground stations: one in Cuiaba and another in Alcantara. A Data Communication Network (RECDAS) and a voice communication network connect all three sites. The ground stations are S band stations. The station equipment is designed to ESA standards. The CCS uses DEC VAX machines: two VAX 8350 and one VAX 11/780. The data transfer between the CCS and the ground stations at the application level follows ESA's protocol. The RECDAS is a private X25 packet switching network with 9600 bps data transmission rate. ESA

N92-20788# Rome Univ. (Italy).
SAN MARCO MOBILE EQUATORIAL RANGE

L. Broglio *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 491-508 (For primary document see N92-20715 11-14)
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Activities performed in the San Marco project, particularly in the San Marco Equatorial Range (SMER), are outlined. SMER, an aerospace research 'mobile' range, is located in Ngwana Bay (Indian Ocean), and consists of two offshore type platforms: the San Marco Platform (assembly and launch pads) and the San Rita Platform (communication, telemetry, and command and control station). Prospects for the future are discussed. ESA

N92-20789# Moscow Inst. of Aviation Technology (USSR). Mission Control Center.
FORMING OF TECHNICAL STRUCTURE AND SOFTWARE FOR SOVIET MISSION CONTROL CENTER

V. I. Lobachev, V. N. Pochukaev, V. V. Malyshev, and M. N. Krasilshikov *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 509-514 (For primary document see N92-20715 11-14)
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The operational structure of the Soviet Mission Control Center (MCC) is considered. The structure of MCC consists of four basic departments: technical (hardware); information-mathematical (software); organizational; and information-reference (data base). The organizational flowcharts of the departments are given. Opportunities and interactions between the different departments are considered. ESA

N92-20844*# Rockwell International Corp., Canoga Park, CA. Rocketdyne Div.
OPERATIONALLY EFFICIENT PROPULSION SYSTEM STUDY (OEPSS) DATA BOOK. VOLUME 1: GENERIC GROUND OPERATIONS DATA Interim Report, 24 Apr. 1989 - 24 Apr. 1990

Raymond J. Byrd 24 Apr. 1990 190 p
(Contract NAS10-11568)
(NASA-CR-188749; NAS 1.26:188749; RI/RD90-149-1-Vol-1)
Avail: NTIS HC/MF A09 CSCL 14B

This study was initiated to identify operations problems and cost drivers for current propulsion systems and to identify technology and design approaches to increase the operational efficiency and reduce operations costs for future propulsion systems. To provide readily usable data for the Advance Launch System (ALS) program, the results of the Operationally Efficient Propulsion System Study (OEPSS) were organized into a series of OEPSS Data Books as follows: Volume 1, Generic Ground Operations Data; Volume 2, Ground Operations Problems; Volume 3, Operations Technology; Volume 4, OEPSS Design Concepts; and Volume 5, OEPSS Final Review Briefing, which summarizes the activities and results of the study. This volume presents ground processing data for a generic LOX/LH2 booster and core propulsion system based on current STS experience. The data presented includes: top logic diagram, process flow, activities bar-chart, loaded

timelines, manpower requirements in terms of duration, headcount and skill mix per operations and maintenance instruction (OMI), and critical path tasks and durations. Author

15 LAUNCH VEHICLES AND SPACE VEHICLES

Includes boosters; operating problems of launch/space vehicle systems; and reusable vehicles.

For related information see also *20 Spacecraft Propulsion and Power.*

N92-20247# Norwegian Defence Research Establishment, Kjeller.
THE MODEL USED IN THE GAS AND THE CWR PROGRAMS
Jan H. Blanch 15 Aug. 1991 13 p
(FFI-91/6007; ISSN-0802-2437; ETN-92-90811) Avail: NTIS HC/MF A03

The computer prediction programs, GAS and CWR deal exclusively with non persistent vapor hazards from conventional tube artillery, Multi Barrel Rocket Launchers (MBRL) and bombs. The GAS program is to be used for single munition and the CWR program for multiple munition. Both programs may be run on an IBM PC (Personal Computer) or compatible. The GAS program has graphical output and needs a PC with graphical capability (VGA, EGA, (CGA) or Hercules graphical adapter). The programs are menu driven and easy to use. The basic model for the GAS and CWR programs for prediction of the chemical primary vapor challenge is based upon the expansion of a half spherical cloud moving with the wind. This model and an ellipsoidal model are discussed. The latter model is used on updated versions of both programs. ESA

N92-20537*# Southwest Research Inst., San Antonio, TX. Instrumentation and Space Research Div.
THE CYCLOTRON ENERGIZATION THROUGH AURORAL WAVE EXPERIMENTS (CENTAUR 2B) Final Report
J. D. Winningham 25 Mar. 1992 142 p
(Grant NAG5-639; SwRI Proj. 15-1518)
(NASA-CR-190137; NAS 1.26:190137) Avail: NTIS HC/MF A07 CSCL 22B

The CENTAUR 2B mission, a dual payload program, is in many aspects the same as the previous missions from Cape Perry and Norway in 1985. It was planned that these payloads would be launched from Andoya, Norway, Nov. 1989 from the Universal II launcher. The payloads are identical, but would have been launched at different azimuths as far north and as far west as possible. Particle experiments include the angular resolving energy analyzer (AREA), the fast ion mass spectrometer (FIMS), the spectrographic particle images (SPI), and finally, the differential ion flux probe (DIFP). SwRI was responsible for the scientific payload, which includes the power supplies, the power supply interfacing, the manipulating of the data from the instruments to format it for the telemetry system, all mechanical structure and restraint mechanisms, and the payload subskin. The status of the various components of this program is given. Author

N92-20666*# Case Western Reserve Univ., Cleveland, OH.
CONCEPTUAL DESIGN OF TWO-STAGE-TO-ORBIT HYBRID LAUNCH VEHICLE
1 Jul. 1991 275 p
(Contract NASw-4435)
(NASA-CR-190006; NAS 1.26:190006) Avail: NTIS HC/MF A12 CSCL 22B

The object of this design class was to design an earth-to orbit vehicle to replace the present NASA space shuttle. The major motivations for designing a new vehicle were to reduce the cost of putting payloads into orbit and to design a vehicle that could better service the space station with a faster turn-around time. Another factor considered in the design was that near-term technology was to be used. Materials, engines and other important technologies were to be realized in the next 10 to 15 years. The first concept put forth by NASA to meet these objectives was the National Aerospace Plane (NASP). The NASP is a single-stage earth-to-orbit air-breathing vehicle. This concept ran into problems with the air-breathing engine providing enough thrust in the upper atmosphere, among other things. The solution of this design class is a two-stage-to-orbit vehicle. The first stage is air-breathing and the second stage is rocket-powered, similar to the space shuttle. The second stage is mounted on the top of the first stage in a piggy-back style. The vehicle takes off horizontally using only air-breathing engines, flies to Mach six at 100,000 feet, and launches the second stage towards its orbital path. The first stage, or booster, will weigh approximately 800,000 pounds and the second stage, or orbiter will weigh approximately 300,000 pounds. The major advantage of this design is the full recoverability of the first stage compared with the present solid rocket booster that are only partially recoverable and used only a few times. This reduces the cost as well as providing a more reliable and more readily available design for servicing the space station. The booster can fly an orbiter up, turn around, land, refuel, and be ready to launch another orbiter in a matter of hours. Author

N92-20667*# Washington Univ., Seattle. Dept. of Aeronautics and Astronautics.
PROJECT ANTARES: A LOW COST MODULAR LAUNCH VEHICLE FOR THE FUTURE Final Report
Steve Aarnio, Hobie Anderson, El Mehdi Arzaz, Michelle Bailey, Jeff Beeghly, Curt Cartwright, William Chau, Andrew Dawdy, Bruce Detert, and Miles Ervin et al 14 Jun. 1991 214 p
(Contract NASw-4435)
(NASA-CR-190018; NAS 1.26:190018) Avail: NTIS HC/MF A10 CSCL 22B

The single stage to orbit launch vehicle Antares is based upon the revolutionary concept of modularity, enabling the Antares to efficiently launch communications satellites, as well as heavy payloads, into Earth's orbit and beyond. The basic unit of the modular system, a single Antares vehicle, is aimed at launching approximately 10,000 kg into low Earth orbit (LEO). When coupled with a Centaur upper stage it is capable of placing 3500 kg into geostationary orbit. The Antares incorporates a reusable engine, the Dual Mixture Ratio Engine (DMRE), as its propulsive device. This enables Antares to compete and excel in the satellite launch market by dramatically reducing launch costs. Antares' projected launch costs are $1340 per kg to LEO which offers a tremendous savings over launch vehicles available today. Inherent in the design is the capability to attach several of these vehicles together to provide heavy lift capability. Any number of these vehicles, up to seven, can be attached depending on the payload and mission requirements. With a seven vehicle configuration Antares's modular concept provides a heavy lift capability of approximately 70,000 kg to LEO. This expandability allows for a wider range of payload options such as large Earth satellites, Space Station Freedom support, and interplanetary spacecraft, and also offers a significant cost savings over a mixed fleet based on different launch vehicles. Author

16 SPACE TRANSPORTATION

Includes passenger and cargo space transportation, e.g., shuttle operations; and space rescue techniques.

For related information see also *03 Air Transportation and Safety* and *18 Spacecraft Design, Testing and Performance.* For space suits see *54 Man/System Technology and Life Support.*

N92-20676*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
PAYLOAD BAY DOORS AND RADIATOR PANELS FAMILIARIZATION HANDBOOK
John A. Godbold [1992] 92 p LIMITED REPRODUCIBILITY: More than 20% of this document may be affected by color photographs Original contains color illustrations

(NASA-TM-107793; NASA-TP-POD-2; NAS 1.15:107793) Avail: NTIS HC/MF A05; 35 functional color pages CSCL 22B

The structure and mechanisms associated with the Payload Bay Doors (PLBDs) and the radiator panels are detailed. The PLBDs allow the radiator panels to be exposed to space, protect payloads from contamination, and provide an aerodynamic fairing over the payload bay. The radiator panels dissipate heat from the orbiter and regulate hydraulic fluid temperature. Contamination in the payload bay can hinder the success of missions. Therefore, the contamination control barrier which the PLBDs provide must be efficient in keeping the bay free from contaminants. The aerodynamic fairing the PLBDs provide prevents the orbiter from being torn apart by aerodynamic forces. These facts make the PLBDs and radiator panels mission critical elements of the Space Shuttle. Author

N92-20955*# National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

DEBRIS/ICE/TPS ASSESSMENT AND PHOTOGRAPHIC ANALYSIS FOR SHUTTLE MISSION STS-44

Gregory N. Katnik, Scott A. Higginbotham, and J. Bradley Davis Jan. 1992 99 p Original contains color illustrations (NASA-TM-103827; NAS 1.15:103827) Avail: NTIS HC/MF A05; 45 functional color pages CSCL 22B

A debris/ice/TPS assessment and photographic analysis was conducted for space shuttle mission STS-44. Debris inspection of the flight elements and launch pad were performed before and after the launch. Ice/frost conditions on the external tank were assessed by the use of computer programs, nomographs, and infrared scanner data during cryogenic loading of the vehicle followed by on-pad visual inspection. High speed photography was analyzed after launch to identify ice/debris sources and evaluate potential vehicle damage and/or in-flight anomalies. The debris/ice/TPS conditions and photographic analysis of mission STS-44 are documented, along with their overall effect on the space shuttle program. Author

N92-20993*# National Aeronautics and Space Administration, Washington, DC.

AEROSPACE SAFETY ADVISORY PANEL Annual Report

Mar. 1992 80 p (NASA-TM-107798; NAS 1.15:107798) Avail: NTIS HC/MF A05 CSCL 22B

The results of the Panel's activities are presented in a set of findings and recommendations. Highlighted here are both improvements in NASA's safety and reliability activities and specific areas where additional gains might be realized. One area of particular concern involves the curtailment or elimination of Space Shuttle safety and reliability enhancements. Several findings and recommendations address this area of concern, reflecting the opinion that safety and reliability enhancements are essential to the continued successful operation of the Space Shuttle. It is recommended that a comprehensive and continuing program of safety and reliability improvements in all areas of Space Shuttle hardware/software be considered an inherent component of ongoing Space Shuttle operations. Author

N92-20628 Aerospatiale, Les Mureaux (France). Groupe Logiciels des Systemes.

HERMES SIMULATION [SIMULATION HERMES]

M. Toussaint *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 463-477 In FRENCH Previously announced in IAA as A91-47790 (For primary document see N92-20589 11-61)

Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

17 SPACE COMM., SPACECRAFT COMM., COMMAND & TRACKING

Includes telemetry; space communications networks; astronavigation and guidance; and radio blackout.

For related information see also *04 Aircraft Communications and Navigation* and *32 Communications and Radar.*

N92-20249# Messerschmitt-Boelkow-Blohm G.m.b.H., Munich (Germany, F.R.).

HIGH ENERGY PROPULSION UNITS FOR THE YEAR 2000 [HOCHENERGIE-TRIEBWERKE FUER DAS JAHR 2000]

P.-A. Kramer, G. Munding, H. Bassner, H.-L. Besser, G. Schmidt, A. Seidel, and K. Smirra 1991 26 p In GERMAN Presented at the Deutscher Luft- und Raumfahrt Kongres 1991 DGLR Jahrestagung, Berlin, Fed. Republic of Germany, 10-13 Sep. 1991 (ETN-92-90989) Avail: NTIS HC/MF A03

The future tasks of space navigation propulsion units for the next two decades are discussed. Necessary loss equipment for commercial satellite launching and higher safety for manned missions are emphasized. Technical requirements and their solution statements are reported. New hypersonic and electrical propulsion units are to be developed in the future. New markets for propulsion units are not envisaged. It is shown that new concepts and technologies are to be studied about fifteen years prior to the applications in order to avoid incalculable risks and erroneous developments. ESA

N92-20504# Tuebingen Univ. (Germany, F.R.). Astronomisches Inst.

PREPARATION AND TESTING OF A SPACE NAVIGATION EXPERIMENT FOR THE IMAGE-FORMING HIGH ENERGY X RAY ASTRONOMY, USING A ROTATION MODULATION COLLIMATOR: DATA TRANSFER AND DATA PROCESSING Thesis [VORBEREITEN UND TESTEN EINES WELTRAUMEXPERIMENTS FUER DIE ABBILDENDE HOCHENERGIE-ROENTGENASTRONOMIE MIT EINEM ROTATIONS-MODULATIONS-KOLLIMATOR: DATENUERBERNAHME UND DATENVERARBEITUNG]

Bernhard Pflueger Jan. 1991 72 p In GERMAN (ETN-92-90634) Avail: NTIS HC/MF A04

The modulation and correlation processes are presented. It is shown that grid geometry contributes decisively to image formation. Differences between laboratory and space measurements are explained. A theoretical and geometrical derivation is given for coarse grid, and for the calculation of grid constants. Personal computer measurements can be evaluated, using programs which allow improved computer speed and maneuverability. Measurements are carried out for two different rotation modulation collimators. The theoretical measurable source strength is calculated. HEXE 2 simulations are carried out. Simulations with data from the region of the Galactic center are evaluated. ESA

18 SPACECRAFT DESIGN, TESTING AND PERFORMANCE

Includes satellites; space platforms; space stations; spacecraft systems and components such as thermal and environmental controls; and attitude controls.

For life support systems see *54 Man/System Technology and Life Support.* For related information see also *05 Aircraft Design, Testing and Performance, 39 Structural Mechanics,* and *16 Space Transportation.*

N92-20068*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

WHIPPLE SHIELD SIZING EQUATIONS

Eric L. Christiansen 1 Mar. 1991 23 p (NASA-TM-105539; NAS 1.15:105539) Avail: NTIS HC/MF A03 CSCL 22B

Wipple shield sizing equations are given for use in current Space Station Freedom (SSF) Work Package 2 (WP-2) trade study

activities. These equations are modifications of the 1969 Cour-Palais predictor equations which were used by McDonnell Douglas to size WP-2 meteoroid and debris shielding for the SSF preliminary design review. Recent hypervelocity impact (HVI) test results have shown that the original 1969 Cour-Palais predictor improperly scales to the particle sizes that the WP-2 shields must be designed to protect against. The original equations have been redesigned to correct this scaling deficiency. Substantial increases to WP-2 shielding weight estimates are indicated by the modified equations. Several possibilities exist, however, to reduce the weight of WP-2 shielding. These equations will be updated in the future as warranted by the results of ultra-high speed (greater than 19 km/sec) HVI tests and further analysis. Author

N92-20210# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
ON THE DYNAMICS AND CONTROL OF THE FIRST BRAZILIAN REMOTE SENSING SATELLITE
Ijar Milagre daFonseca and Jose Francisco Ribeiro Jun. 1991 6 p Presented at the 1st International Conference on Spacecraft Guidance, Navigation and Control Systems, Noordwijk, Netherlands, 4-7 Jun. 1991; sponsored by ESTEC
(INPE-5273-PRE/1687) Avail: NTIS HC/MF A02

A summary of the Brazilian Remote Sensing Mission and the mathematical model of the First Brazilian Remote Sensing Satellite, and the attitude dynamics analysis taking into account the active control performed by a reaction wheel, jet gas and magnetic coil are presented. The main objectives are to test the control law and to analyze the interaction between the control system and the elastic motion of the satellite solar arrays. The equations of motion were derived by the Lagrangian approach for quasi-coordinates (rotational motion) and for generalized coordinated (elastic motion). The attitude equations were written in terms of quaternion. The gravity gradient torque was also considered. The results show that the control works well and that no significant interaction between the control system and the elastic motion of the solar arrays exists. Author

N92-20822*# GTE Government Systems Corp., Chantilly, VA.
SIMULATOR DESIGN FOR ADVANCED ISDN SATELLITE DESIGN AND EXPERIMENTS Task Completion Report, 25 Sep. 1990 - 1 Mar. 1992
Gerald R. Pepin 30 Mar. 1992 70 p
(Contract NASw-4520)
(NASA-CR-190140; NAS 1.26:190140) Avail: NTIS HC/MF A04 CSCL 22B

This simulation design task completion report documents the simulation techniques associated with the network models of both the Interim Service ISDN (integrated services digital network) Satellite (ISIS) and the Full Service ISDN Satellite (FSIS) architectures. The ISIS network model design represents satellite systems like the Advanced Communication Technology Satellite (ACTS) orbiting switch. The FSIS architecture, the ultimate aim of this element of the Satellite Communications Applications Research (SCAR) program, moves all control and switching functions on-board the next generation ISDN communication satellite. The technical and operational parameters for the advanced ISDN communications satellite design will be obtained from the simulation of ISIS and FSIS engineering software models for their major subsystems. Discrete events simulation experiments will be performed with these models using various traffic scenarios, design parameters and operational procedures. The data from these simulations will be used to determine the engineering parameters for the advanced ISDN communications satellite. Author

N92-21023# SRI International Corp., Menlo Park, CA.
TRANSIENT PULSE MONITOR (TPM) Final Report, Sep. 1986 - Apr. 1991
D. R. Dana Nov. 1991 77 p
(Contract F19628-86-C-0231)
(AD-A244502; PL-TR-91-2131) Avail: NTIS HC/MF A05 CSCL 14/2

The Transient Pulse Monitor (TPM) detects and characterizes transient electric fields and currents on satellites to help investigate arc discharge phenomena affecting spacecraft operation in various space environments. The TPM was originally developed to measure arc discharge parameters for several different experiments on a combined mission. However, in its present configuration, the TPM will be used to characterize arc discharges resulting from high-voltage solar-array operation (simulated by biasing) in the low- to medium-altitude space-plasma environment for Phillips Laboratory's Photovoltaic Array Space Power Plus Diagnostics (PASP Plus) experiment. This report describes the TPM design, the nature of its measurements, and the results of the calibration and environmental testing of the instrument in its flight configuration as part of the PASP Plus Experiment. Author (GRA)

N92-21051# Edgerton, Germeshausen and Grier, Inc., Idaho Falls, ID.
MAGNETIC SHIELDING FOR INTERPLANETARY SPACECRAFT
J. S. Herring and B. J. Merrill 1991 11 p Presented at the 28th Space Congress, Cocoa Beach, FL, 23-26 Apr. 1991
(Contract DE-AC07-76ID-01570)
(DE92-003295; EGG-M-90501; CONF-9104322-1) Avail: NTIS HC/MF A03

The protection of spacecraft crews from the radiation produced by high energy electrons, protons and heavier ions in the space environment is a major health concern on long duration missions. Conventional approaches to radiation shielding in space have relied on thicker spacecraft walls to stop the high energy charged particles and to absorb the resulting gamma and bremsstrahlung photons. The shielding concept described here uses superconducting magnets to deflect charged particles before they collide with the spacecraft, thus avoiding the production of secondary particles. A number of spacecraft configurations and sizes have been analyzed, ranging from a small 'storm cellar' for use during solar flares to continuous shielding for space stations having a crew of 15-25. The effectiveness of the magnetic shielding has been analyzed using a Monte Carlo program with incident proton energies from 0.5 to 1000 MeV. Typically the shield deflects 35-99 percent of the incident particles, depending, of course on particle energy and magnetic field strength. Further evaluation studies have been performed to assess weight comparisons between magnetic and conventional shielding; to determine magnet current distributions which minimize the magnetic field within the spacecraft itself; and to assess the potential role of ceramic superconductors. DOE

N92-20779# European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.). Mission Analysis Section.
OVERVIEW ON EUROPEAN ACTIVITIES ON SPACE DEBRIS
Walter Flury *In its* Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 427-432 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

N92-20780# Technische Univ., Brunswick (Germany, F.R.). Inst. for Spaceflight and Nuclear Reactor Technology.
CLOSING THE DATA GAP OF SPACE DEBRIS: GROUND BASED OR SPACE BASED SENSORS?
Peter Eichler, J. Bendisch, and J. Zhang *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 433-438 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

N92-20781*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
TECHNIQUES FOR DEBRIS MITIGATION
Joseph P. Loftus, Jr. *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 439-446 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

N92-20782*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
RADAR MEASUREMENTS OF THE ORBITAL DEBRIS ENVIRONMENT
Eugene G. Stansbery and Carl C. Pitts (XonTech, Inc., Los Angeles, CA.) *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 447-452 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders CSCL 22B

19 SPACECRAFT INSTRUMENTATION

For related information see also *06 Aircraft Instrumentation* and *35 Instrumentation and Photography.*

No abstracts in this category.

20 SPACECRAFT PROPULSION AND POWER

Includes main propulsion systems and components, e.g., rocket engines; and spacecraft auxilliary power sources.

For related information see also *07 Aircraft Propulsion and Power, 28 Propellants and Fuels, 44 Energy Production and Conversion,* and *15 Launch Vehicles and Space Vehicles.*

N92-20065*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
ATOMIC OXYGEN DURABILITY OF SOLAR CONCENTRATOR MATERIALS FOR SPACE STATION FREEDOM
Kim K. deGroh, Judith A. Terlep, and Therese M. Dever (Cleveland State Univ., OH.) 1990 13 p Presented at the 5th Annual Air Force Workshop on Surface Reactions in the Space Environment, Evanston, IL, 24-25 Sep. 1990; sponsored by Northwestern Univ.
(Contract NCC3-19)
(NASA-TM-105378; E-6745; NAS 1.15:105378) Avail: NTIS HC/MF A03 CSCL 10B

The findings are reviewed of atomic oxygen exposure testing of candidate solar concentrator materials containing SiO2 and Al2O3 protective coatings for use on Space Station Freedom solar dynamic power modules. Both continuous and iterative atomic oxygen exposure tests were conducted. Iterative air plasma ashing resulted in larger specular reflectance decreases and solar absorptance increases than continuous ashing to the same fluence, and appears to provide a more severe environment than the continuous atomic oxygen exposure that would occur in the low Earth orbit environment. First generation concentrator fabrication techniques produced surface defects including scratches, macroscopic bumps, dendritic regions, porosity, haziness, and pin hole defects. Several of these defects appear to be preferential sites for atomic oxygen attack leading to erosive undercutting. Extensive undercutting and flaking of reflective and protective coatings were found to be promoted through an undercutting tearing propagation process. Atomic oxygen erosion processes and effects on optical performance is presented. Author

N92-20243*# Thiokol Corp., Brigham City, UT. Space Operations.
EVALUATION OF RSRM CASE HARDWARE FRETTING CONCERNS
Thomas R. Swauger 11 Oct. 1990 40 p
(Contract NAS8-30490)
(NASA-CR-184287; NAS 1.26:184287; TWR-60352) Avail: NTIS HC/MF A03 CSCL 21H

Fretting corrosion was first noted on Shuttle flight STS-26. This flight was the first usage of the Redesigned Solid Rocket Motor (RSRM). The occurrence of fretting has since been observed on both the field and factory joints of the RSRM. Fretting is a form of corrosion that occurs at the interface between contacting, highly loaded, metal surfaces when exposed to slight relative vibratory motions. The engineering effort performed to evaluate the effect of fretting on the RSRM case hardware is summarized. Based on the results of this evaluation, several conclusions were made concerning flight safety. Also, recommendations were made concerning trending the effects of multiple generations of fretting damage. D.R.D.

N92-20271*# Pratt and Whitney Aircraft, West Palm Beach, FL. Goverment Engines and Space Propulsion Div.
ADVANCED EXPANDER TEST BED ENGINE Annual Technical Progress Report No. 2, 1 Jan. - 31 Dec. 1992
J. P. Mitchell Mar. 1992 27 p
(Contract NAS3-25960)
(NASA-CR-189130; NAS 1.26:189130; FR-21319-2) Avail: NTIS HC/MF A03 CSCL 21H

The Advanced Expander Test Bed (AETB) is a key element in NASA's Space Chemical Engine Technology Program for development and demonstration of expander cycle oxygen/hydrogen engine and advanced component technologies applicable to space engines as well as launch vehicle upper stage engines. The AETB will be used to validate the high pressure expander cycle concept, study system interactions, and conduct studies of advanced mission focused components and new health monitoring techniques in an engine system environment. The split expander cycle AETB will operate at combustion chamber pressures up to 1200 psia with propellant flow rates equivalent to 20,000 lbf vacuum thrust. Author

N92-20355*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
NUCLEAR ELECTRIC PROPULSION TECHNOLOGY PANEL FINDINGS AND RECOMMENDATIONS
Michael P. Doherty 1992 11 p Presented at the 9th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 12-16 Jan. 1992
(NASA-TM-105547; E-6870; NAS 1.15:105547) Avail: NTIS HC/MF A03 CSCL 21C

Summarized are the findings and recommendations of a triagency (NASA/DOE/DOD) panel on Nuclear Electric Propulsion (NEP) Technology. NEP has been identified as a candidate nuclear propulsion technology for exploration of the Moon and Mars as part of the Space Exploration Initiative (SEI). The findings are stated in areas of system and subsystem considerations, technology readiness, and ground test facilities. Recommendations made by the panel are summarized concerning: (1) existing space nuclear power and propulsion programs, and (2) the proposed multiagency NEP technology development program. Author

N92-20443*# Alabama Univ., Huntsville. Dept. of Mechanical Engineering.
EXPERIMENTAL UNCERTAINTY SURVEY AND ASSESSMENT Final Technical Report, 15 Aug. 1991 - 14 Jan. 1992
Hugh W. Coleman Jan. 1992 19 p
(Contract NAS8-38609)
(NASA-CR-184297; NAS 1.26:184297) Avail: NTIS HC/MF A03 CSCL 21H

An uncertainty analysis and assessment of the specific impulse determination during Space Shuttle Main Engine testing is reported. It is concluded that in planning and designing tests and in interpreting the results of tests, the bias and precision components of experimental uncertainty should be considered separately. Recommendations for future research efforts are presented. Author

N92-20522*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
HYDROGEN/OXYGEN AUXILIARY PROPULSION TECHNOLOGY
Brian D. Reed and Steven J. Schneider 1991 23 p Presented

at the Conference on Advanced Space Exploration Initiative Technologies, Cleveland, OH, 4-6 Sep. 1991; cosponsored by AIAA, NASA, and OAI
(NASA-TM-105249; E-6578; AIAA-91-3440; NAS 1.15:105249)
Avail: NTIS HC/MF A03 CSCL 21H

A survey is provided of hydrogen/oxygen (H/O) auxiliary propulsion system (APS) concepts and low thrust H/O rocket technology. A review of H/O APS studies performed for the Space Shuttle, Space Tug, Space Station Freedom, and Advanced Manned Launch System programs is given. The survey also includes a review of low thrust H/O rocket technology programs, covering liquid H/O and gaseous H/O thrusters, ranging from 6600 N (1500 lbf) to 440 mN (0.1 lbf) thrust. Ignition concepts for H/O thrusters and high temperature, oxidation resistant chamber materials are also reviewed. Author

N92-20585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
A STUDY OF Na(x)Pt3O4 AS AN O2 ELECTRODE BIFUNCTIONAL ELECTROCATALYST
William L. Fielder and Joseph Singer Dec. 1991 25 p
(NASA-TM-105311; E-6664; NAS 1.15:105311) Avail: NTIS HC/MF A03 CSCL 10B

The present study suggests that polytetrafluoroethylene (PTFE) bonded Na(X)Pt3O4 gas porous diffusion electrodes may be a viable candidate for bifunctional O2 reduction and evolution activity. The electrodes exhibited Tafel slopes of about 0.06 V/decade for both O2 reduction an evolution. For O2 reduction, the 0.06 slope doubled to 0.12 V/decade at larger current densities. Preliminary stability testing at 24 C suggest that the Na(x)Pt3O4 electrodes were relatively stable at reducing and oxidizing potentials typically encountered at the O2 electrodes in a regenerative fuel cell. Author

N92-20949*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
OPTICAL MEASUREMENTS ON SOLID SPECIMENS OF SOLID ROCKET MOTOR EXHAUST AND SOLID ROCKET MOTOR SLAG
F. E. Roberts, III Washington Dec. 1991 20 p
(NASA-TP-3177; M-674; NAS 1.60:3177) Avail: NTIS HC/MF A03 CSCL 21H

Samples of aluminum slag were investigated to aid the Earth Science and Applications Division at the Marshall Space Flight Center (MSFC). Alumina from space motor propellant exhaust and space motor propellant slag was examined as a component of space refuse. Thermal emittance and solar absorptivity measurements were taken to support their comparison with reflectance measurements derived from actual debris. To determine the similarity between the samples and space motor exhaust or space motor slag, emittance and absorbance results were correlated with an examination of specimen morphology. Author

N92-21024# Space Power, Inc., San Jose, CA.
COORDINATED FUSE-CONTROLLER SYSTEM FOR MULTIPLE ARCJET OPERATION Final Report, 26 Jul. 1990 - 14 Jun. 1991
See-Pok Wong Dec. 1991 31 p
(Contract F04611-90-C-0083)
(AD-A244507; SPI-51-4; PL-TR-91-3078) Avail: NTIS HC/MF A03 CSCL 21/3

An innovative approach of connecting multiple arcjet thrusters to a single arcjet power conditioning unit (PCU) is presented. The approach uses fuses and a coordinated electronic controller to perform the functions of operating multiple thrusters with one PCU, therefore, eliminating the need for high current, high voltage arcjet selector switches. The phase 1 effort will design the controller and identify the proper fuse as well as conduct liaison with other high power arcjet experimenters to verify this innovative approach. Author (GRA)

N92-21037# General Electric Co., Philadelphia, PA. Astro Space Div.
CRAF/CASSINI RTG PROGRAM
24 Oct. 1991 15 p
(Contract DE-AC03-91SF-18852)
(DE92-001945; DOE/SF-18852/T7) Avail: NTIS HC/MF A03

The technical progress achieved during the period April 1 through September 29, 1991 on Contract DE-AC03-91SF-18852, Radioisotope Thermoelectric Generators and Ancillary Activities is described herein. The report is organized by the program task structure as follows: Spacecraft Integration and Liaison, Engineering Support, Safety, Qualified Unicouple Production, ETG Fabrication, Assembly and Test, Ground Support Equipment (GSE), RTG Shipping and Launch Support, Designs, Reviews, and Mission Applications, Project Management, Quality Assurance and Reliability, and CAGO Acquisition (Capital Funds). DOE

N92-21043# Los Alamos National Lab., NM.
SOME NEW IDEAS FOR NUCLEAR EXPLOSIVE SPACECRAFT PROPULSION
J. C. Solem Oct. 1991 17 p
(Contract W-7405-eng-36)
(DE92-003009; LA-12189-MS) Avail: NTIS HC/MF A03

Because of the deleterious effects of galactic cosmic radiation, solar flares, zero gravity, and psychological stress, there is a strong motivation to develop high-specific-impulse and high-thrust spacecraft for rapid transport of astronauts between the planets. I present a novel spacecraft design using a large lightweight sail (spinnaker) driven by the pressure pulses from a series of nuclear explosions. The spacecraft appears to be a singularly competent and economical vehicle for high-speed interplanetary travel. Remarkably, the mass of the spinnaker is theoretically independent of the size of its canopy or the number or length of its tethers. Consequently, the canopy can be made very large to minimize radiation damage from the nuclear explosions and the tethers can be made very long to mitigate radiation hazard to the crew. I calculate the specific impulse of the nuclear explosive propellant as a function of the mass and yield of the explosives and the thrust as a function of yield and repetition rate. I show that the weight of the sail can be greatly reduced by tethering the canopy in many places on its surface and that the canopy mass is directly proportional to the bomb yield and inversely proportional to the number of tethers. The pressure from the nuclear explosion imparts a large impulsive acceleration to the lightweight spinnaker, which must be translated to a small smooth acceleration of the space capsule by using either the elasticity of the tethers or a servo winch in the space capsule or a combination of the two. Finally, I derive the optimum canopy shape and show that it will generally intercept about 2(pi) of the solid angle from the detonation point. Should the political questions connected with this unconventional use of nuclear explosives be favorably resolved, the invention will be a good candidate for propulsion in the Mars mission. DOE

N92-20922# Tokyo Univ., Sagamihara (Japan).
ATTITUDE CONTROL SYSTEM OF THE RETRIEVAL TYPE ROCKET S-520
Ichiro Nakatani, Junichiro Kawaguchi, Rituo Hasegawa, Masaru Abe, and Kazuhiko Ashina (Mitubichi Precision Co. Ltd., Japan) *In its* Proceedings of the Symposium on Mechanics for Space Flight 1990 Mar. 1991 p 47-52 (For primary document see N92-20918 11-34)
Avail: NTIS HC/MF A05

23 CHEMISTRY AND MATERIALS (GENERAL)

N92-20429# Washington Univ., Seattle. Dept. of Materials Science and Engineering.
WORKSHOP ON THE DESIGN AND PROCESSING OF MATERIALS BY BIOMIMICKING Final Report, 1 Mar. - 31 Aug. 1991
Mehmet Sarikaya and Ilhan A. Aksay Nov. 1991 23 p Workshop held in Seattle, WA, 2-4 Apr. 1991
(Grant AF-AFOSR-0177-91; AF Proj. 2303; AF Proj. 2302)
(AD-A243858; AFOSR-91-0991TR) Avail: NTIS HC/MF A03 CSCL 01/2

Biomimicking is now regarded as an area of research in which the analysis of natural materials will provide insights into the design of novel manmade materials, resulting in superior structures able to withstand the requirements placed upon advanced materials. It is well recognized that biological systems efficiently produce complex composites possessing unique properties with greater control than is possible with synthetic materials. Biological materials often have hierarchical structures with unprecedented properties at spatial levels on the molecular, micrometer, and macrometer seals. The dynamism of these systems allows the collection and transport of constituents; the nucleation, configuration, and growth of new structures by self-assembly; and the repair and replacement of old or damaged components. With this in mind, this workshop is intended to identify the most critical issues and to establish future directions for biomimicking in materials science and engineering. The goals of this workshop are to further educate the Air Force participants in the possibilities of biomimetric design and processing and to encourage the research participants to address the interfacing of these possibilities with aerospace needs. Natural materials cannot be used for many aerospace applications because of their chemical instability at the temperatures associated with their use. GRA

24 COMPOSITE MATERIALS

Includes physical, chemical, and mechanical properties of laminates and other composite materials.
For ceramic materials see *27 Nonmetallic Materials.*

N92-20136# Oak Ridge National Lab., TN.
MICROSTRUCTURAL ANALYSIS AND MECHANISMS OF DEFORMATION OF HOT-PRESSED SiC WHISKER-REINFORCED SILICON NITRIDE
K. L. More, D. A. Koester, and R. F. Davis (North Carolina State Univ., Raleigh.) 1991 7 p Presented at the 1st International Symposium on the Science of Engineering Ceramics, Osaka, Japan, 21-25 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005169; CONF-9110307-1) Avail: NTIS HC/MF A02

Extensive microstructural characterization has been conducted to complement the kinetics data obtained from constant compressive stress creep experiments in order to determine the mechanisms of creep in a 30 vol percent SiC whisker-reinforced Si3N4 composite. The ranges of temperature and stress employed for the deformation studies were 1470-1670 K and 50-350 MPa, respectively. Marked changes in both activation energy at approximately 1570 K for all stress levels and stress exponent at approximately 225 MPa for temperatures greater than 1470 K indicate a possible change in creep mechanism. Electron microscopy and X-ray diffraction have been used to characterize and compare the microstructures of the as-received, annealed, and crept materials. The break in the stress exponent curves was caused by the removal of residual glass from the grain boundaries. The break in the activation energy curves is believed to be similarly related. Analysis of the data indicates that the composite creeps via grain boundary sliding accommodated by viscous flow at low temperatures and stresses and by diffusion at high temperatures and stresses. DOE

N92-20193*# Arizona State Univ., Tempe. Telecommunications Research Center.
ADVANCED ELECTROMAGNETIC METHODS FOR AEROSPACE VEHICLES Semiannual Progress Report, 1 Jul. - 31 Dec. 1991
Constantine A. Balanis, El-Budawy El-Sharawy, Shahrokh Hashemi-Yeganeh, James T. Aberle, and Craig R. Birtcher 31 Dec. 1991 64 p
(Grant NAG1-1082)
(NASA-CR-188630; NAS 1.26:188630) Avail: NTIS HC/MF A04 CSCL 11D

The Advanced Helicopter Electromagnetics is centered on issues that advance technology related to helicopter electromagnetics. Progress was made on three major topics: composite materials; precipitation static corona discharge; and antenna technology. In composite materials, the research has focused on the measurements of their electrical properties, and the modeling of material discontinuities and their effect on the radiation pattern of antennas mounted on or near material surfaces. The electrical properties were used to model antenna performance when mounted on composite materials. Since helicopter platforms include several antenna systems at VHF and UHF bands, measuring techniques are being explored that can be used to measure the properties at these bands. The effort on corona discharge and precipitation static was directed toward the development of a new two dimensional Voltage Finite Difference Time Domain computer program. Results indicate the feasibility of using potentials for simulating electromagnetic problems in the cases where potentials become primary sources. In antenna technology the focus was on Polarization Diverse Conformal Microstrip Antennas, Cavity Backed Slot Antennas, and Varactor Tuned Circular Patch Antennas. Numerical codes were developed for the analysis of two probe fed rectangular and circular microstrip patch antennas fed by resistive and reactive power divider networks. Author

N92-20295# Los Alamos National Lab., NM.
MICROWAVE ASSISTED CHEMICAL VAPOR INFILTRATION
D. J. Devlin, R. P. Currier, R. S. Barbero, B. F. Espinoza, and N. Elliott 1991 7 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract W-7405-eng-36)
(DE92-005019; LA-UR-91-3850; CONF-911202-11) Avail: NTIS HC/MF A02

A microwave assisted process for production of continuous fiber reinforced ceramic matrix composites is described. A simple apparatus combining a chemical vapor infiltration reactor with a conventional 700 W multimode oven is described. Microwave induced inverted thermal gradients are exploited with the ultimate goal of reducing processing times on complex shapes. Thermal gradients in stacks of SiC (Nicalon) cloths have been measured using optical thermometry. Initial results on the 'inside out' deposition of SiC via decomposition of methyltrichlorosilane in hydrogen are presented. Several key processing issues are identified and discussed. DOE

N92-20320 Virginia Polytechnic Inst. and State Univ., Blacksburg.
ON ISO- AND NONISOTHERMAL CRACK PROBLEMS OF A LAYERED ANISOTROPIC ELASTIC MEDIUM Ph.D. Thesis
Hyung Jip Choi 1991 217 p
Avail: Univ. Microfilms Order No. DA9136279

The iso- and non-isothermal crack problems of layered fiber-reinforced composite materials are investigated within the framework of linear anisotropic thermoelasticity and under the state of generalized plane deformation. The crack is assumed to be parallel to the layer bounding surfaces. By employing the Fourier integral transform technique and the flexibility/stiffness matrix formulation, the current mixed boundary value problems are reduced to solving a set of simultaneous singular integral equations

with Cauchy-type kernels. The crack-tip stress intensity factors are then defined in terms of the solution of the integral equations. Numerical results are presented addressing the salient and unique features for a class of crack problems involving highly anisotropic fibrous composite materials. Specifically, the cases of a crack embedded, (1) within a homogeneous and anisotropic slab; (2) between two bonded dissimilar anisotropic half-spaces; and (3) within the matrix-rich interlaminar region of a generally laminated anisotropic slab, are considered. The effects of relative crack size, crack location, and fiber volume fraction on the stress intensity factors are examined as a function of fiber angle. For the case of layered composites, the matrix-rich interlaminar region is modeled as a separate interlayer. As the interlayer thickness approaches zero, the interlaminar crack model illustrates no smooth transition to the ideal interface crack model of zero interlayer thickness which exhibits oscillatory stress singularities. The mixed-model crack top response is shown to involve the simultaneous presence of three fracture modes. It is demonstrated that the corresponding values of stress intensity factors are strongly influenced by the laminate stacking sequence and layer orientation. In addition, the partially insulated crack surface condition is observed to alleviate the severity of thermally-induced stress fields near the crack tip. Dissert. Abstr.

N92-20482*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
THE EFFECTS OF UNEVEN FIBER SPACING ON THERMAL RESIDUAL STRESSES IN A UNIDIRECTIONAL SCS-6TI-15-3 LAMINATE
C. A. Bigelow Mar. 1992 46 p
(NASA-TM-104225; NAS 1.15:104225) Avail: NTIS HC/MF A03 CSCL 11D

High residual stresses develop in SCS-6/Ti-15-3 composites during cooldown from the fabrication temperature; these residual stresses can effect the mechanical and physical properties of the composite. Discrete fiber-matrix finite element models were used to study the residual stresses due to the temperature change during the fabrication process, including the effects of uneven fiber spacing, the free surface, and increased fiber volume fractions. To accurately model the effects of the free surface, it is only necessary to model one fiber through the thickness. Below the first ply, the analysis predicts stress distributions that are identical to the infinite array predictions. For uneven fiber space less then 0.042 mm in an interior ply, the maximum hoop stress was predicted to occur between fibers within a ply and to increase as the fiber spacing decreased. The maximum hoop stress correlated well with the observed radial cracking between fibers. For the case of touching fibers, the analysis predicted tensile radial stresses at the fiber-matrix debonding during the fabrication cooldown. Identical trends were predicted for uneven fiber spacing in surface plies with slightly greater values of maximum stresses. The analysis predicted matrix yielding to occur upon cooldown when the edge-to-edge fiber spacing was less than or equal to 0.022 mm. The stress distributions predicted for increasing fiber volume fractions were similar to those predicted for decreasing the fiber spacing for two adjacent fibers within a ply. Author

N92-20484*# Northwestern Univ., Evanston, IL. School of Engineering and Applied Science.
ENVIRONMENTAL AND STRAIN RATE EFFECTS ON GRAPHITE/EPOXY COMPOSITES Final Report; M.S. Thesis, 1987
Konstantinos Peimandis Oct. 1991 293 p
(Grant NAG3-423)
(NASA-CR-187229; NAS 1.26:187229) Avail: NTIS HC/MF A13 CSCL 11D

The hygrothermal characterization of unidirectional graphite/epoxy composites over a range of strain rates was investigated. Special techniques developed for such hygrothermal characterization are also described. The mechanical properties of the composite material were obtained and analyzed by means of a time-temperature-moisture superposition principle. The results show the following: (1) the embedded gage technique was thoroughly examined and found to be appropriate for both hygrothermal expansion and mechanical strain measurements; (2) all transverse properties were found to decrease with increasing temperature and moisture content; and (3) ultimate transverse properties were found to increase with strain rate at low temperatures but follow an opposite trend at high temperatures compared to dry specimens. Author

N92-20521*# Akron Univ., OH.
SUPERELEMENT METHODS IN HIGH TEMPERATURE METAL MATRIX COMPOSITES Final Report; M.S. Thesis, 1989
Daniel Trowbridge Nov. 1991 396 p
(Grant NAG3-50)
(NASA-CR-189070; NAS 1.26:189070) Avail: NTIS HC/MF A17 CSCL 11D

A study into fiber fracture and debonding in metal matrix composites is conducted using the finite element method. The superelement finite element technique was used to model a metal matrix composite under various loading condition and with varying degrees of fiber debonding. The use of superelement saved many man hours by allowing for alteration of only the primary superelement to manipulate partial bonding for the entire model. The composite's material properties were calculated and the effects of fiber debonding on these properties were noted. The internal stress state of the composite while under various loads was also studied. Special interest was devoted to the change in stress state as a result of increasing fiber debonding. Author

N92-20527 Michigan Univ., Ann Arbor.
ANALYSIS OF COMPOSITE MATERIALS SUBJECTED TO A UNILATERAL CONTACT CONDITION WITH ADHESION ON THE INTERFACE OF ITS CONSTITUENTS Ph.D. Thesis
Marcelo Krajnc Alves 1991 267 p
Avail: Univ. Microfilms Order No. DA9135550

A theory is developed for the solution of dissipative dynamic problems involving a subclass of composite materials defined by those which are assembled using an adhesive element. In this subclass, we also give particular attention to composite materials having a periodic cell structure pattern, where an arbitrarily large number of such cells exist. We consider part of the boundary and the interface between two different components of composite material to undergo a unilateral contact with adhesion condition. We also consider the inclusion of frictional effects which may occur, when a relative tangential velocity between two surfaces in contact exist on the adhesive surfaces after a total debonding takes place. The generalized forces associated with the mathematical model are obtained from nonconvex superpotentials by forming the local subdifferential of the superpotential at the given point. The complementary equations are obtained by introducing pseudo-potentials of dissipation and applying in these potentials the hypothesis of normal dissipation. Because of the lack of differentiability of these superpotentials and and psuedo-potentials, we employ a regularization method where a smoothing procedure is applied to these nondifferentiable potentials. In order to solve this class of problems, we perform a semidiscretization of the weak regularized formulation of the problem. This semidiscretization uses the finite element method for the interpolation of the geometric domain and employs an explicit finite difference method to take into account the time evolution of the problem. Dissert. Abstr.

N92-20561# Japan Atomic Energy Research Inst., Tokyo.
IRRADIATION EFFECTS ON RESISTANCE TO THERMAL IMPACT FOR COMPOSITES USED IN SPACE, 2
Akira Udagawa, Tsuneo Sasuga, Tadao Seguchi, Kenji Nakao, Toshio Sakakibara, Noriaki Sugahara, Takayuki Kamiyama, Yosuke Nagao, and Katsumi Kamei (Fuji Heavy Industries Ltd., Utsunomiya, Japan) Jun. 1991 52 p In JAPANESE; ENGLISH summary
(DE92-731701; JAERI-M-91-099) Avail: NTIS HC/MF A04

Mechanical properties of carbon-fiber-reinforced plastics (CFRP) and adhesives which are of practical importance for structural materials in space systems, were studied after being exposed to individual radiation, thermal shock, and a combination

of both of them. The IM-6/6376 composite, which includes the modified TGDDM(DDS) matrix and high strength intermediate modulus carbon fiber (IM-6), showed sufficient adoptability for space material. The mechanical properties for fiber directions of 0 and 90 deg did not change after irradiation of up to 10 MGy and/or after thermal shock of up to 3000 cycles (-100 to approximately 100 C). Preliminary experiments were carried out using an interlaminar adhesive panel with modified epoxy resin-adhesive films. The resistance of adhesives to thermal shock was dependent on the commercial products, so that it was difficult to classify the curing condition of adhesives. It was also found that the thickness of adhesives in the panel specimens should be increased and the adhesion strength was greatly affected by thermal expansion of the adherends. The CFRP with polyimide resins such as PMR-15 and the newly developed CFRP with new-TPI possessed the same initial mechanical properties and no microcracks appeared after their exposure to radiation and thermal shocks. It was revealed that these materials showed high resistance to radiation and thermal shock which is of interest for their use in space systems. DOE

N92-20679*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
OPTIMIZATION OF COMPOSITE SANDWICH COVER PANELS SUBJECTED TO COMPRESSIVE LOADINGS
Juan R. Cruz Dec. 1991 13 p
(NASA-TP-3173; L-16942; NAS 1.60:3173) Avail: NTIS HC/MF A03 CSCL 11D

An analysis and design method is presented for the design of composite sandwich cover panels that include the transverse shear effects and damage tolerance considerations. This method is incorporated into a sandwich optimization computer program entitled SANDOP. As a demonstration of its capabilities, SANDOP is used in the present study to design optimized composite sandwich cover panels for for transport aircraft wing applications. The results of this design study indicate that optimized composite sandwich cover panels have approximately the same structural efficiency as stiffened composite cover panels designed to satisfy individual constraints. The results also indicate that inplane stiffness requirements have a large effect on the weight of these composite sandwich cover panels at higher load levels. Increasing the maximum allowable strain and the upper percentage limit of the 0 degree and +/- 45 degree plies can yield significant weight savings. The results show that the structural efficiency of these optimized composite sandwich cover panels is relatively insensitive to changes in core density. Thus, core density should be chosen by criteria other than minimum weight (e.g., damage tolerance, ease of manufacture, etc.). Author

N92-20707# Pennsylvania Univ., Philadelphia.
COMPOSITE MATERIAL INTERFACE MECHANICS Final Report, 1 Mar. 1989 - 31 Dec. 1991
Z. Hashin 1991 35 p
(Contracts N00014-86-K-0799; N00014-90-J-1750; N00014-91-J-4044)
(AD-A244787) Avail: NTIS HC/MF A03 CSCL 11/4

The major part of the scientific work reported here has been concerned with quantification of the concept of imperfect interface, the modifications of the theory of composite materials for imperfect interface and evaluation of the effect of various kinds of imperfect interface on various properties of various composite materials. In addition a study of the effect of matrix nonlinearity and imperfect interface on the critical compressive stress of unidirectional fiber composites has been performed. The work included the following: (1) Thermoelastic properties of fiber composites with imperfect interface; (2) Composite materials with viscoelastic interphase; (3) Micromechanics aspects of damage in composite materials; (4) The spherical inclusion with imperfect interface conditions; (5) Thermoelastic properties of particulate composites with imperfect interface; and (6) Effect of matrix nonlinearity and imperfect interface on compressive strength of fiber composites. GRA

N92-20808*# Vitro Corp., Washington, DC.
A GUIDE TO STRUCTURAL FACTORS FOR ADVANCED COMPOSITES USED ON SPACECRAFT
Robert VanWagenen Aug. 1989 42 p
(Contract NASw-4311)
(NASA-CR-186010; NAS 1.26:186010) Avail: NTIS HC/MF A03 CSCL 11D

The use of composite materials in spacecraft systems is constantly increasing. Although the areas of composite design and fabrication are maturing, they remain distinct from the same activities performed using conventional materials and processes. This has led to some confusion regarding the precise meaning of the term 'factor of safety' as it applies to these structures. In addition, composite engineering introduces terms such as 'knock-down factors' to further modify material properties for design purposes. This guide is intended to clarify these terms as well as their use in the design of composite structures for spacecraft. It is particularly intended to be used by the engineering community not involved in the day-to-day composites design process. An attempt is also made to explain the wide range of factors of safety encountered in composite designs as well as their relationship to the 1.4 factor of safety conventionally applied to metallic structures. Author

N92-20824# Army Lab. Command, Watertown, MA. Material Technology Lab.
PITCH BASED SHORT CARBON FIBER Final Report
Sin-Shong Lin Dec. 1991 18 p
(AD-A244780; MTL-TR-91-51) Avail: NTIS HC/MF A03 CSCL 11/2

Short carbon fiber manufactured from coal tar pitch by Osaka Gas Co. is examined by chemical composition analysis, X-ray powder diffraction, optical microscope, and electron spectroscopic techniques. The present analytical results are compared with the data obtainable from other sources. Owing to the low cost of the short fiber, it is recommended that the fiber could be used for a wide variety of reinforcement applications such as cement/concrete mixtures, polymer composites, and high temperature materials. Processing includes the mechanical separation of mesophase microbeads of three to 30 micron diameters from crude coal tar during three heat treatment stages. The mesophases obtained are then subjected to solvent extraction, hydrogenation, and polymerization to yield isotropic and anisotropic pitches suitable for melt spinning. The short fiber is fabricated from isotropic pitch by the rotary gas jet method, and the process yields a higher quality fiber as compared to other melt spinning methods. The most important feature is that this process is highly cost effective. GRA

N92-20838*# IIT Research Inst., Chicago, IL.
HIGH STRAIN RATE PROPERTIES OF UNIDIRECTIONAL COMPOSITES, PART 1 Final Contractor Report
I. M. Daniel Dec. 1991 460 p
(Contract NAS3-21016)
(NASA-CR-189083; NAS 1.26:189083) Avail: NTIS HC/MF A20 CSCL 11D

Experimental methods were developed for testing and characterization of composite materials at strain rates ranging from quasi-static to over 500 s(sup -1). Three materials were characterized, two graphite/epoxies and a graphite/S-glass/epoxy. Properties were obtained by testing thin rings 10.16 cm (4 in.) in diameter, 2.54 cm (1 in.) wide, and six to eight plies thick under internal pressure. Unidirectional 0 degree, 90 degree, and 10 degree off-axis rings were tested to obtain longitudinal, transverse, and in-plane shear properties. In the dynamic tests internal pressure was applied explosively through a liquid and the pressure was measured with a calibrated steel ring. Strains in the calibration and specimen rings were recorded with a digital processing oscilloscope. The data were processed and the equation of motion solved numerically by the mini-computer attached to the oscilloscope. Results were obtained and plotted in the form of dynamic stress-strain curves. Longitudinal properties which are governed by the fibers do not vary much with strain rate with only

a moderate (up to 20 percent) increase in modulus. Transverse modulus and strength increase sharply with strain rate reaching values up to three times the static values. The in-plane shear modulus and shear strength increase noticeably with strain rate by up to approximately 65 percent. In all cases ultimate strains do not vary significantly with strain rates. Author

N92-20841*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
EFFECT OF HEAT TREATMENT ON STIFFNESS AND DAMPING OF SiC/Ti-15-3
Joseph E. Grady and Bradley A. Lerch 1992 10 p Proposed for presentation at the 1992 Winter Annual Meeting of the ASME, Anaheim, CA, 8-13 Nov. 1992
(NASA-TM-105564; E-6888; NAS 1.15:105564) Avail: NTIS HC/MF A02 CSCL 11D

The effect of heat treatment on material properties of SiC/Ti-15-3 was measured by vibration tests. Heat treatment changes the microstructure, which was found to stiffen the matrix and reduce its damping capacity. Test results indicate how these changes in the matrix affect the corresponding properties of the composite. Measurements show that heat treatment affects damping properties of the composite to a greater extent than stiffness properties. The extent of change in mechanical properties is shown to depend on heat treatment temperature and exposure time. Author

N92-20848# Israel Aircraft Industries Ltd., Ben-Gurion Airport. TASHAN Engineering Center.
IMPACT DAMAGE ASSESSMENT OF COMPOSITES
S. Girshovich, T. Gottesman, H. Rosenthal, E. Drukker, and Y. Steinberg Nov. 1990 34 p
(IAITIC-90-1014; ITN-92-85134) Avail: NTIS HC/MF A03

For failure prediction of impact damaged composite structures, NDE (NonDestructive Evaluation) methods for damage characterization, in combination with subsequent stress analysis were investigated. As a model for this study, the NASA/Industry Standard Compression After Impact test configuration was chosen. Damage characterization incorporated C-scan ultrasonic inspection to produce planar mapping of damage areas. No information could be inferred from C-scans regarding distribution and discrete location of cracks, delaminations and other defects in the through-thickness direction. Computerized and manual pulse echo ultrasonic testing from both sides of the test panels provided additional information on 3-D damage geometry. However, this method is restricted by the masking effect of near-surface defects on damage deeper within the material. Radiographic methods were developed to provide a more complete representation of the impact damage. The combination of microfocus techniques with radio-opaque penetrants enabled 3-D mapping of the size and distribution of delaminations and transverse cracks in damaged areas.
Author (ISA)

N92-20853# Virginia Univ., Charlottesville. Dept. of Materials Science.
PROCESSING, STRUCTURE AND PROPERTIES OF HEAVILY DEFORMED IN SITU COMPOSITES Final Report, 1 Jun. 1988 - 31 May 1991
T. H. Courtney 31 May 1991 31 p
(Contract DAAL03-88-K-0091)
(AD-A244841) Avail: NTIS HC/MF A03 CSCL 11/4

Microstructural stability, particularly stability in heavily deformed in situ composites, has been studied and classified systematically. Mechanisms and avenues for the breakdown of plate like structures have been identified, and the conditions under which the several types of instability take place have been specified. Clarification of the strengthening mechanisms that operate in deformation processed composite materials has been made. Tensile and fracture characteristics of metal-metallic glass laminates have been investigated. Laminate fracture toughnesses are much greater than for the metallic glass. This is due to a crack closing force provided by the metal for which the crack lags behind that in the glass. The toughening mechanism has been described in quantitative as well as qualitative terms. Fundamental modeling of the mechanical alloying process has been made from both a mechanics standpoint and a kinetic one. Experimental studies complement analysis. Amorphization behavior of nickel-tungsten alloys during mechanical alloying has been systematically investigated, as has the subsequent crystallization behavior of these materials. Consolidation of mechanically alloyed Ni-W and copper-niobium materials has been investigated. Models of hot isostatic pressing have been used to mimic the densification behavior of mechanically alloyed materials for this process. GRA

N92-20880*# IIT Research Inst., Chicago, IL.
HIGH STRAIN RATE PROPERTIES OF ANGLE-PLY COMPOSITE LAMINATES, PART 3 Final Report
I. M. Daniel Dec. 1991 383 p
(Contract NAS3-21016)
(NASA-CR-189085; NAS 1.26:189085) Avail: NTIS HC/MF A17 CSCL 11D

Angle-ply graphite/epoxy and graphite/S-glass/epoxy laminates were characterized in uniaxial tension at strain rates ranging from quasi-static to over 500 s(sup -1). Laminate ring specimens of +/-15(sub 2s), +/-22.5(sub 2s), +/-30(sub 2s), +/-45(sub 2s), +/-60(sub 2s), +/-67.5(sub 2s), and +/-75(sub 2s) degree layups were loaded under internal pressure. Results were presented in the form of stress-strain curves to failure. Properties determined included moduli, Poisson's ratios, strength, and ultimate strain. In all seven laminates for the two materials tested the modulus and strength increase with strain rate. The effect of strain rate varies with layup, being lowest for the fiber dominated +/-15(sub 2s) degree laminates and highest for the matrix dominated +/-75(sub 2s) degree laminates. The highest increments over the static values are 10 to 25 percent for the +/-15(sub 2s) degree layup and 200 to 275 percent for the +/-75(sub 2s) degree layup. Ultimate strains do not show any significant trends with strain rate. In almost all cases the ultimate strain values are within +/-20 percent of the mean value and in half of the cases the deviation from the mean are less than 10 percent. Author

N92-20894*# IIT Research Inst., Chicago, IL.
HIGH STRAIN RATE PROPERTIES OF OFF-AXIS COMPOSITE LAMINATES, PART 2 Final Report, 11 Jul. 1977 - 11 Apr. 1981
I. M. Daniel Dec. 1991 172 p
(Contract NAS3-21016; IITRI Proj. M-06026)
(NASA-CR-189084; NAS 1.26:189084) Avail: NTIS HC/MF A08 CSCL 11D

Unidirectional off-axis graphite/epoxy and graphite/-S-glass/epoxy laminates were characterized in uniaxial tension at strain rates ranging from quasi-static to over 500 s(sup -1). Laminate ring specimens were loaded by internal pressure with the tensile stress at 22.5, 30, and 45 degrees relative to the fiber direction. Results were presented in the form of stress-strain curves to failure. Properties determined included moduli, Poisson's ratios, strength, and ultimate strain. In all three laminates of both materials the modulus and strength increase sharply with strain rate, reaching values roughly 100, 150, and 200 percent higher than corresponding static values for the 22.5(sub 8), 30(sub 8), and 45(sub 8) degree laminates, respectively. In the case of ultimate strain no definite trends could be established, but the maximum deviation from the average of any value for any strain rate was less than 18 percent. Author

N92-20929# Rolls-Royce Ltd., Derby (England).
A STUDY OF THE IMPACT OF CORRUGATED SANDWICH PANELS USING DYNA3D AND 2D
R. P. Greaves 1 Jun. 1990 19 p Sponsored by RAE
(PNR-90783; ETN-92-90769) Copyright Avail: NTIS HC/MF A03

In recent years, the need to increase the power to weight ratio of modern aeroengines, at lower overall cost, has led to the development of many new construction techniques. One of these, currently under development is the use of diffusion bonding and superplastic forming of a titanium alloy, to manufacture sandwich

panels with corrugated cores. The result is a structural material with a high specific stiffness which is manufactured by a highly automated process. With the possibility of using such materials in areas of an aeroengine which are exposed to impact from birds, ice, etc., a basic research program was carried out involving impact tests on specimens of this material. These tests were carried out in three modes of loading using an impulse bar technique. The use of both Dyna three dimension (3D) and two dimension (2D) to model these laboratory tests is discussed. It covers important aspects of discretization, the use of nodal constraints, the problems of hourglassing, and the need to use high strain rate material property data. It concludes that the codes can be used to obtain accurate estimates of the transverse dynamic properties of sandwich panels with corrugated cores, and to predict changes in the mode of deformation of such structures with variations in geometry. ESA

N92-20950*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
A STATISTICAL COMPARISON OF TWO CARBON FIBER/EPOXY FABRICATION TECHNIQUES
A. J. Hodge Washington Dec. 1991 12 p
(NASA-TP-3179; M-673; NAS 1.60:3179) Avail: NTIS HC/MF A03 CSCL 11D

A statistical comparison of the compression strengths of specimens that were fabricated by either a platen press or an autoclave were performed on IM6/3501-6 carbon/epoxy composites of 16-ply (0,+45,90,-45)(sub S2) lay-up configuration. The samples were cured with the same parameters and processing materials. It was found that the autoclaved panels were thicker than the platen press cured samples. Two hundred samples of each type of cure process were compression tested. The autoclaved samples had an average strength of 450 MPa (65.5 ksi), while the press cured samples had an average strength of 370 MPa (54.0 ksi). A Weibull analysis of the data showed that there is only a 30 pct. probability that the two types of cure systems yield specimens that can be considered from the same family. Author

25 INORGANIC AND PHYSICAL CHEMISTRY

Includes chemical analysis, e.g., chromatography; combustion theory; electrochemistry; and photochemistry.

For related information see also *77 Thermodynamics and Statistical Physics.*.

N92-20075*# Pennsylvania State Univ., University Park. Propulsion Engineering Research Center.
COMBUSTION OF LOX WITH H2(SUB g) UNDER SUBCRITICAL, CRITICAL, AND SUPERCRITICAL CONDITIONS (TASK 1) AND EXPERIMENTAL OBSERVATION OF DENSE SPRAY AND MIXING OF IMPINGING JETS (TASK 2) Annual Report
K. K. Kuo, W. H. Hsieh, F. B. Cheung, A. S. Yang, J. J. Brown, R. D. Woodward, M. C. Kline, and R. L. Burch 28 Feb. 1992 77 p Original contains color illustrations
(Grant NAG8-174)
(NASA-CR-190113; NAS 1.26:190113) Avail: NTIS HC/MF A05; 2 functional color pages CSCL 21B

The objective was to achieve a better understanding of the combustion processes of liquid oxygen and gaseous hydrogen under broad range of pressure covering subcritical, critical, and supercritical conditions. The scope of the experimental work falls into the following areas: (1) design of the overall experimental setup; (2) modification of an existing windowed high pressure chamber; (3) design of the LOX feeding system; (4) provision of the safety features in the test rig design; (5) LOX cleanliness requirements; (6) cold shock testing; (7) implementation of data acquisition systems; (8) preliminary tests for system checkout; (9) modification of LOX feeding system; and (10) evaporation tests. Progress in each area is discussed. Author

N92-20088# Sandia National Labs., Livermore, CA.
THE STRUCTURE OF TURBULENT NONPREMIXED FLAMES OF METHANOL OVER A RANGE OF MIXING RATES
A. R. Masri, R. W. Dibble (California Univ., Berkeley.), and R. S. Barlow 1992 17 p Presented at the 30th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992
(Contract DE-AC04-76DR-00789)
(DE92-006683; SAND-92-8400C; AIAA-92-0583; CONF-920157-3) Avail: NTIS HC/MF A03

The blowoff and electrical connectedness characteristics of pilot stabilized turbulent nonpremixed flames of methanol fuel are presented. Using the joint Raman-Rayleigh-LIF technique, simultaneous space- and time-resolved measurements of temperature and the mass fractions of CH3OH, CO, CO2, H2, H2O, O2, and N2 are also shown for a number of measurement locations. Flames with slow mixing rates as well as ones close to blowoff are investigated. The results are presented in the form of scatter plots as well as probability density functions conditioned with respect to mixture fraction for a number of mixture fraction ranges selected within the reactive zone for methanol. The local extinction characteristics in the flames are also studies by adopting a temperature threshold below which fluid samples are assumed to be extinguished. It is found that the flame becomes electrically disconnected completely while it remains visibly and aurally stable for a range of velocities just below blowoff. Measurements in regions of the flames where the mixing rates are relatively low show little difference between the turbulent flame data and the laminar flame compositions only on the lean side of stoichiometric. DOE

N92-20093# Ames Lab., IA.
TRANSIENT INFRARED SPECTROSCOPY
R. W. Jones and J. F. McClelland 1991 2 p Presented at the 7th International Topical Meeting on Photoacoustics and Photothermal Phenomena, Doorwerth (Netherlands), 26-30 Aug. 1991
(Contract W-7405-eng-82)
(DE92-006585; IS-M-687; CONF-9108192-1) Avail: NTIS HC/MF A01

Transient infrared spectroscopy is a pair of closely related techniques that allow measurement of useful spectra from opaque, moving materials. In the techniques a transient thermal gradient is used to spectroscopically isolate a thin surface layer from the bulk of the sample. The basic elements of the techniques and some industrially relevant applications are described. DOE

N92-20127# Utah Univ., Salt Lake City.
LIGAND INTERMEDIATES IN METAL-CATALYZED REACTIONS
J. A. Gladysz Sep. 1991 12 p
(Contract DE-FG02-85ER-13411)
(DE92-005538; DOE/ER-13411/2) Avail: NTIS HC/MF A03

This report presents the most important points of six papers that were published in the past year. The papers are investigations of the following topics: pi/sigma equilibria in aldehyde and ketone complexes; abstraction of vinylic protons from alkene complexes; mechanism of rearrangement of alkylidene to alkene complexes; rearrangement of terminal acetylene to vinylidene complexes; synthesis and reactivity of lithiocarbide complexes; new catalysts for the epimerization of secondary alcohols; and carbon-hydrogen bond activation in alkoxide complexes. DOE

N92-20231# Ecole Centrale de Lyon (France). Lab. de Mecanique des Fluides et d'Acoustique.
EXPERIMENTAL STUDY OF THE INTERACTION OF TWO FLAME FRONTS Final Summary Report [ETUDE EXPERIMENTALE DE L'INTERACTION DE DEUX FRONTS DE FLAMMES. RAPPORT DE SYNTHESE FINALE]
D. Escudie and D. Laurrauri 1991 51 p In FRENCH
(Contract DRET-87-254)
(ETN-92-91076) Avail: NTIS HC/MF A04

The experimental study of the interaction of two oblique flame fronts is addressed. Interaction in laminar flow and its evolution

when the flow carries predefined vortex structures, produced by a Karman street, are examined. The extension of the case to a turbulent flow is addressed. The techniques used, essentially nonintrusive, are laser tomography for topology description and laser Doppler anemometry for aerodynamic field quantization.
ESA

N92-20305# Evans (Charles) and Associates, Redwood City, CA.
DEVELOPMENT OF QUANTITATIVE LASER IONIZATION MASS SPECTROMETRY (LIMS) Final Report, 1 Aug. 1987 - 1 Jan. 1990
R. W. Odom 4 Jun. 1991 80 p
(Grant NSF ISI-87-00019)
(PB92-122902; CEVANS/055/FR-9108; NSF/ISI-91006) Avail: NTIS HC/MF A05 CSCL 07D

The development of quantitative microanalysis methods for dielectric thin films using the laser ionization mass spectrometry (LIMS) technique was investigated. The research involved preparation of thin (5,000 A) films of SiO2, Al2O3, MgF2, TiO2, Cr2O3, Ta2O5, Si3N4, and ZrO2, and doping these films with ion implant impurities of 11B, 40Ca, 56Fe, 68Zn, 81Br, and 121 Sb. Laser ionization mass spectrometry (LIMS), secondary ion mass spectrometry (SIMS) and Rutherford backscattering spectrometry (RBS) were performed on these films. The research demonstrated quantitative LIMS analysis down to detection levels of 10-100 ppm, and led to the development of the following: (1) a compound thin film standards product line for the performing organization; (2) routine LIMS analytical methods; and (3) the manufacture of high speed preamplifiers for time-of-flight mass spectrometry (TOF-MS) techniques.
GRA

N92-20329# Sandia National Labs., Livermore, CA. Computational Mechanics Div.
SIMULATION OF CHEMICAL KINETICS IN TURBULENT NATURAL GAS COMBUSTION Annual Report, Apr. 1990 - Mar. 1991
A. E. Lutz Sep. 1991 55 p
(Contract GRI-5089-260-1893)
(PB92-123660; GRI-91/0282) Avail: NTIS HC/MF A04 CSCL 21B

A computationally efficient model that predicts chemical kinetic phenomena in a turbulent natural gas jet was developed. It was used to compute the nitric oxide (NOx) emissions measured in the lab jet flames. The model explains qualitatively the variation in the emissions with nozzle diameter, jet velocity, and fuel type. The predicted emission levels are consistently higher than the measured values; uncertainties in the radiative heat transfer and turbulent mixing rates can account for the discrepancy. The objective is to develop chemical kinetic models that are computationally efficient, yet retain the detailed chemistry model necessary to predict kinetically controlled phenomena, such as NOx formation in turbulent natural gas combustion. To do this, the first model uses two perfectly stirred reactors to represent combustion in the homogeneous eddies and the diffusion flame sheets that are observed in the large scale structure of turbulent jets. The entrainment and mixing of surrounding fluid with the jet stream is modeled using empirical correlations derived from experimental observations. These entrainment correlations take into account both momentum dominated and buoyant flow regimes. An important part of the model is the radiative energy loss, because the NOx emission is very sensitive to the flame temperature.
Author

N92-20331# Aerodyne Research, Inc., Billerica, MA. Center for Chemical and Environmental Physics.
HETEROGENEOUS CHEMISTRY OF METHANOL, FORMALDEHYDE AND FORMIC ACID: LABORATORY MEASUREMENTS OF MASS ACCOMMODATION COEFFICIENTS ON LIQUID WATER DROPLETS Final Report
P. Davidovits, J. T. Jayne, S. X. Duan, D. W. Worsnop, and M. S. Zahniser Sep. 1991 51 p Prepared in cooperation with Boston Coll., Chestnut Hill, MA Sponsored in part by Coordinating Research Council, Inc., Atlanta, GA
(PB92-118983; ARI-RR-882; CRC-APRAC-ME-5) Avail: NTIS HC/MF A04 CSCL 07D

Emissions from automobiles are important precursors of urban ozone. Because of the persistency of the problem, alternative cleaner fuels are being considered. Methanol and ethanol are prime candidates for the purpose. Since substantial emissions of methanol and its combustion products would be released into the atmosphere, it is important to consider the fate of these compounds in the environment. The relatively long chemical lifetime of methanol in the atmosphere implies that mixing clouds and fogs is likely and hence heterogeneous chemical mechanisms on aqueous droplets may be important in the degradation of these compounds. Presented are the results of a systematic study aimed at understanding the nature of the interaction between gas phase alcohols, aldehydes, and organic acids with aqueous surfaces.
Author

N92-20337 Virginia Polytechnic Inst. and State Univ., Blacksburg.
MODIFIED SOURCE-TYPE FLAME MODEL AND VORTICITY GENERATED BY THE FLAME AND BLUFF BODIES Ph.D. Thesis
Shiung-Po Kao 1991 195 p
Avail: Univ. Microfilms Order No. DA9136289

A numerical model is developed to simulate the wrinkled laminar flame sheet flapping in weakly turbulent premixed combustion. The wrinkled laminar flame sheet is represented by a discrete distribution of volume sources called source disks. These source disks are utilized to produce the acceleration of combustion products behind the flame sheet. The laminar flame speed is allowed to vary according to flame stretch. A modified source model is proposed against the background of the existing source model's physically unrealistic symmetric expansion in both the upstream and the downstream directions. This flame model also includes flame-generated vorticity which is associated with the increasing entropy intrinsic to any system going through an irreversible process. Flame-flow interactions are studied when a thin circular cylinder, a large circular cylinder, and a flat plate normal to freestream are used as flame holders. Results show that when the modified source model gives more accurate prediction of flame angle than the existing source model does, the relative errors can be reduced by as much as four times. The modified source model also produces velocity profiles closer to those found in experiment, the deviations are cut by half at most sampling points in the flow. The vorticity shed from a thin circular cylinder flame stabilizer is found to only influence downstream regions very close to the cylinder. The eddy shedding behind a bluff body flame holder is suppressed in reacting flow simulations and the computed recirculating zone in a reacting flow is nearly half as long as that in a cold flow. When the relative size of the flame holder is one order of magnitude larger than the thickness of flame sheet, the vorticity shed by the flame holder can no longer be neglected. Flame wrinkling and flame extinction caused by vortical fluid motion behind the flame holder are found through numerical simulation.
Dissert. Abstr.

N92-20435*# Auburn Univ., AL. Dept. of Physics.
CHEMICAL REACTION OF ATOMIC OXYGEN WITH EVAPORATED FILMS OF COPPER, PART 4 Final Report
A. T. Fromhold and J. R. Williams 30 Jun. 1990 109 p
(Contract NAS8-36471)
(NASA-CR-184286; NAS 1.26:184286) Avail: NTIS HC/MF A06 CSCL 07D

Evaporated copper films were exposed to an atomic oxygen flux of 1.4 x 10(exp 17) atoms/sq cm per sec at temperatures in the range 285 to 375 F (140 to 191 C) for time intervals between 2 and 50 minutes. Rutherford backscattering spectroscopy (RBS) was used to determine the thickness of the oxide layers formed and the ratio of the number of copper to oxygen atoms in the layers. Oxide film thicknesses ranged from 50 to 3000 A (0.005 to 0.3 microns, or equivalently, 5 x 10(exp -9) to 3 x 10(exp -7); it was determined that the primary oxide phase was Cu2O. The

growth law was found to be parabolic (L(t) varies as t(exp 1/2)), in which the oxide thickness L(t) increases as the square root of the exposure time t. The analysis of the data is consistent with either of the two parabolic growth laws. (The thin-film parabolic growth law is based on the assumption that the process is diffusion controlled, with the space charge within the growing oxide layer being negligible. The thick-film parabolic growth law is also based on a diffusion controlled process, but space-charge neutrality prevails locally within very thick oxides.) In the absence of a voltage measurement across the growing oxide, a distinction between the two mechanisms cannot be made, nor can growth by the diffusion of neutral atomic oxygen be entirely ruled out. The activation energy for the reaction is on the order of 1.1 eV (1.76 x 10(exp -19) joule, or equivalently, 25.3 kcal/mole). Author

N92-20451# Case Western Reserve Univ., Cleveland, OH. Dept. of Chemistry.
IN SITU SPECTROSCOPIC STUDIES OF TRANSITION METAL MACROCYCLES AS CATALYSTS FOR THE ELECTROCHEMICAL REDUCTION OF OXYGEN Final Report, 1 Dec. 1986 - 31 Mar. 1991
D. A. Scherson Jun. 1991 165 p
(Contract GRI-5086-260-1403)
(PB92-123728; GRI-91/0223) Avail: NTIS HC/MF A08 CSCL 07D

The feasibility of in situ Mossbauer Effect Spectroscopy (MES) and X-ray Absorption Fine Structure (XFAS) experiments involving transition metal macrocycles adsorbed on high area carbon was demonstrated using mu-oxobis(iron meso-tetrakis(methoxyphenyl)) porphyrin as a model compound. Additional insight into the nature of the bonding between this type of catalyst and smooth carbon surfaces was obtained from in situ potential modulated reflection absorption UV-visible spectroscopy. Such measurements involved cobalt tetrasulfonated phthalocyanine (CoTsPc) adsorbed at submonolayer coverages on the basal plane of highly oriented pyrolytic graphite (HOPG). Experiments using in situ Fourier Transform Infrared Reflection Absorption Spectroscopy (FTIRRAS) as a probe of the vibrational properties of this class of adsorbed materials were not informative. Nevertheless, this technique was extensively employed for studies involving irreversibly adsorbed species. Also examined with FTIRRAS were the effects of ionic transport in diffusionally decoupled thin layers of electrolyte of the type commonly found in IR spectroelectrochemical experiments. Complementary information regarding changes in the orientation of such self assembled monolayers was obtained from in situ electronic linear dichroism. An instrument was developed for in situ magnetic circular dichroism measurements of electrodes in the reflection absorption mode. Dissert. Abstr.

N92-20524*# Iowa Univ., Iowa City. Dept. of Chemistry.
THEORETICAL STUDY OF THE DESIGN OF A CATALYST FOR PARA TO ORTHO HYDROGEN CONVERSION Final Report
Robert E. Coffman 25 Mar. 1992 138 p
(Grant NAG3-1056)
(NASA-CR-190163; NAS 1.26:190163) Avail: NTIS HC/MF A07 CSCL 07D

The theory of Petzinger and Scalapino (1973) was thoroughly reviewed, and all of the basic equations for paramagnetic para to ortho hydrogen catalysis re-derived. There are only a few minor phase errors and errors of omission in the description of the theory. Three models (described by Petzinger and Scalapino) for the rate of para to ortho H2 catalysis were worked out, and uniform agreement obtained to within a constant factor of 2 pi. The analytical methods developed in the course of this study were then extended to two new models, which more adequately describe the process of surface catalysis including transfer of hydrogen molecules onto and off of the surface. All five equations for the para to ortho catalytic rate of conversion are described. The two new equations describe the catalytic rate for these models: H2 on the surface is a 2-D gas with lifetime tau; and H2 on the surface is a 2-D liquid undergoing Brownian motion (diffusion) with surface lifetime tau. Author

N92-20529# Los Alamos National Lab., NM.
MOESSBAUER SPECTROSCOPY AT PRESSURES UP TO 40 GPa
R. D. Taylor and M. P. Pasternak (Tel-Aviv Univ., Israel) 20 Nov. 1991 7 p Presented at the 29th Meeting of the European High Pressure Group, Tehessaloniki, Greece, 13 Nov. 1991
(Contract W-7405-eng-36)
(DE92-005072; LA-UR-91-3912; CONF-9111166-1) Avail: NTIS HC/MF A02

Mossbauer spectroscopy (MS) is a viable 'non-contact' technique applicable to high pressure, diamond anvil cells (DAC) with samples containing a wide variety of the elements suitable for MS. The convenience and simplicity of diamond anvil cells as a means to obtain static high pressures even into the megabar regime has resulted in a renewed interest in pressure as a complement to the usual physical measurements. However, the required small sample size and the difficulty of communicating with the sample leave only x ray and optical spectroscopy as the readily available tools. Mossbauer spectroscopy which involves recoil-free, low energy gamma rays, provides a powerful additional technique to study a myriad of physical properties in a DAC. MS concerns a particular isotope and can provide local information on phase changes and hysteresis, isomer shifts, valence, bonding, magnetic and quadrupolar interactions, lattice dynamics, and multiple sites. The Mossbauer effect has been seen in about a hundred isotopic transitions in about forty different elements; many are suitable for DAC-MS, most notably Fe-57, Sn-119, Sb-121, Te-125, I-129, Sn-149, Eu-151, Dy-161, Au-1976, Np-237. Since the information available from MS is obtained from analyzing the precise energy profile of the Mossbauer gamma ray from a source/absorber combination, no contacts or difficult coupling to the DAC are required. We review a number of salient features of the DAC-MS method and present some examples, including new work on FeI2. DOE

N92-20559# Lawrence Livermore National Lab., CA.
LUMINESCENCE OF Sm(2+) IONS IN NON-CUBIC HIGH PRESSURE ALPHA PHASE OF DIVALENT FLUORIDES
C. S. Yoo, N. C. Holmes, and H. B. Radousky Nov. 1991 5 p Presented at the 13th AIRAPT International Conference on High Pressure Science and Technology, Bangalore (India), 7-11 Oct. 1991
(Contract W-7405-eng-48)
(DE92-006897; UCRL-JC-109023; CONF-9110228-6) Avail: NTIS HC/MF A01

The luminescence spectra of Sm(2+) impurities are characteristic of the local site symmetry and, thus, the bulk crystal phases of SrF2 and CaF2. In this study we have used the Sm(2+) luminescence spectra to monitor the beta yields alpha transitions of SrF2 at 5 GPa and of CaF2 at 8.5 GPa. In contrast to those in the beta phase, the Sm(2+) spectra in the alpha phase show a series of sharp 4f-4f transition bands, even at 300 K, originating from the sup 5 D sub o level to sup 7 F sub j multiplets including a strong transition for (Delta)J = O. At low temperatures, these transitions are not observed; instead, the 4f sup 5 5d sup 1 band of the Sm(2+) ions in the beta phase shifts below the sup 5 D sub o (4f sup 6) level at 4.5 GPa and 30 K. The nature of the SM(2+) luminescence spectra in the alpha and beta phases of SrF2 and CaF2 at several pressures and temperatures will be discussed. DOE

N92-20577# Brookhaven National Lab., Upton, NY.
RESPONSE OF LIQUID ARGON AND SOME ADDITIVES TO IONIZING RADIATION AND THEIR USE IN CALORIMETERS
D. C. Rahm 1991 10 p Presented at the Conference on Liquid Noble Gas Detectors and Their Applications, Stockholm, Sweden, 21-23 Aug. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005377; BNL-46888; CONF-9108188-1) Avail: NTIS HC/MF A02

Measurements on drift velocities and collected charge were made in a small test dewar on liquid argon with admixtures of methane, ethane, ethylene, and ammonia using alpha and beta

particle sources. In addition a test in the Helios uranium-liquid argon calorimeter was made with a 0.35 percent addition of methane. The results in the Helios calorimeter showed a worsening of the hadronic resolution and the electron/pion ratio. DOE

N92-20580# Northwestern Univ., Evanston, IL.
CHEMICAL INTERACTIONS IN MULTIMETAL/ZEOLITE CATALYSTS
W. M. H. Sachtler Nov. 1991 6 p
(Contract DE-FG02-87ER-13654)
(DE92-005537; DOE/ER-13654/5) Avail: NTIS HC/MF A02

The mechanisms operating in the formation of bimetal (alloy) particles inside Y zeolites were studied in detail. The simple view that the more noble metal is reduced first, such that its clusters will serve as nuclei for the reduction of the less noble metal, was verified for the case of Pd+Ni, but simultaneously it was shown that two other mechanisms are also contributing. In this research we confirmed our earlier discovery that zeolite protons selectively oxidize the atoms of the less noble metal in each alloy particle. This 'leaching' leads to a situation where all atoms of one metal are present as clusters, while all atoms of the other metal in the same zeolite are present as cations. Leaching was confirmed for Pt+Cu, Pd+Cu, and Pd+Ni in Y zeolite. In another approach we studied the potential for redispersion of large metal or alloy particles in zeolites, i.e., in situ rejuvenation of catalysts after substantial sintering of the metal. This approach was successful. Our strategy is to first oxidize the metal and let the resulting ions disperse in small cages throughout the zeolite matrix. Subsequent reduction under mild conditions results in small metal particles. DOE

N92-20641# Altex Technologies Corp., Santa Clara, CA.
CHARACTERIZATION OF NONPREMIXED TURBULENT BLUFF-BODY BURNER FLAMES Annual Report, Jan. - Dec. 1990
J. Kelly, M. Namazian, R. Schefer, and M. Perrin 10 Jun. 1991 98 p Prepared in cooperation with Sandia National Labs.; and Gaz de France
(Contract GRI-5086-260-1250)
(PB91-243105; GRI-91/0185) Avail: NTIS HC/MF A05 CSCL 21B

Sampling probe species concentration measurements in unconfined bluff body stabilized flames showed that Blockage Ratio (BR) did not increase the NOx emissions. However, at high BR, confinement increased NOx emissions by a factor of two. CH/CH4 imaging data in unconfined and confined bluff body flames were obtained. It was shown that the flame regime responds to the recirculation zone fuel concentration. The knowledge was used to predict the flame regime map. CH/CH4 data, along with previous Mie scattering results, show that the extended stability of the confined flame is due to the presence of a wall recirculation zone. High resolution imaging measurements of CH in a lifted, turbulent jet flame showed that the reaction zone consists of high CH regions separated by lower CH regions. These observations are consistent with the distributed reaction zone model. The axisymmetric vortex dynamic model was completed, validated, and applied to a ten-to-one diameter ratio bluff body. Results showed that the flow has significant large scale vortex shedding at velocity ratios from .67 to .8, and has vortex shedding interspaced with lull periods above this velocity ratio. This behavior will have implications relative to flame stability, turndown, and emissions. Author

N92-20658# Ceramatec, Inc., Salt Lake City, UT.
DEVELOPMENT OF THIN-FILM, MIXED-CONDUCTIVE MEMBRANES FOR OXYGEN SEPARATION Annual Report, 1 Jul. 1990 - 30 Jun. 1991
M. Liu, Y. Shen, J. Ludlow, and A. Joshi 30 Jun. 1991 74 p
(Contract GRI-5090-260-1985)
(PB92-122852; Ceramatec-91564/02; GRI-91/0265) Avail: NTIS HC/MF A04 CSCL 07D

Pressure-activated oxygen separation based on mixed-conuctive membranes is a very attractive approach for economic production of pure oxygen. In order to estimate the oxygen separation rate of such a system, a mathematical model incorporating electrode kinetics and transport properties was developed. Effects of material properties, system design, and operating conditions on oxygen separation rate were clearly illustrated. Theoretical analysis also results in a number of fundamental flux equations, which govern the operation of a system based on mixed conductors and constitute cornerstones for characterization of mixed conductors. Several new approaches were introduced for separation of transport properties in the bulk phase from interfacial processes, for separation of ionic from electronic transport properties, and for investigation of catalytic activity of mixed conductors. Finally, a number of novel mixed conductors were developed at Ceramatec. The materials demonstrated higher oxygen permeability than many O2(-)-e(-) conductors reported in the literature such as La(1-x)Sr(x)MnO(3-delta) and La(1-x)Sr(x)Co(1-y)Fe(y)O(3-delta). GRA

N92-20695# Yale Univ., New Haven, CT. High Temperature Chemical Reaction Engineering Lab.
TRANSPORT PHENOMENA AND INTERFACIAL KINETICS IN MULTIPHASE COMBUSTION SYSTEMS Final Report, 1 Jan. 1989 - 31 Dec. 1990
Daniel E. Rosner Feb. 1991 148 p
(Grant AF-AFOSR-0223-89)
(AD-A244849; AFOSR-91-1035TR) Avail: NTIS HC/MF A07 CSCL 21/2

The performance of ramjets burning slurry fuels (leading to condensed oxide aerosols and liquid film deposits), gas turbine engines in dusty atmospheres, or when using fuels from nontraditional sources (e.g., shale-, or coal-derived), depends upon the formation and transport of small particles across non-isothermal combustion gas boundary layers (BLs). Even airbreathing engines burning clean hydrocarbon fuels can experience soot formation/deposition problems (e.g., combustor liner burnout, accelerated turbine blade erosion and hot corrosion). Moreover, particle formation and transport are important in many chemical reactors used to synthesize or process aerospace materials (turbine blade coatings, optical waveguides, etc.). Accordingly, our research is directed toward providing chemical propulsion system engineers and materials-oriented engineers with new techniques and quantitative information on important particle- and vapor-mass transport mechanisms and rates. An interactive experimental/theoretical approach has been used to gain understanding of performance-limiting chemical-, and mass/energy transfer-phenomena at or near interfaces. This included the further development and exploitation of seeded laboratory flat flame burners, flow-reactors, and new optical diagnostic techniques. GRA

N92-20801# Technische Univ., Eindhoven (Netherlands).
TOPOCHEMISTRY IN FORMATION AND REACTIVITY OF PHOSPHORUS-CENTERED RADICALS: A COMBINED ESR AND THEORETICAL STUDY Ph.D. Thesis
Olav Marcus Aagaard 1991 190 p Sponsored by Netherlands Organization for Scientific Research
(ETN-92-91040) Avail: NTIS HC/MF A09

An Electron Spin Resonance (ESR) study in X-irradiated single crystals of two diastereoisomeric organophosphorus compounds reveals that the yield of electron capture radicals is modulated by intermolecular interactions. Irradiation of both compound unfrozen 2-methyltetrahydrofuran solutions results in identical radical products. An analysis of the van der Waals interactions in the crystal shows that the geometry relaxation necessary for the radical stabilization is easily accommodated in the first isomer, whereas it is obstructed in the second. The intermolecular directed radiogenic formation of phosphoranyl radicals from chiral diphiosphine disulfides is presented. The topochemical directed course of the enantioselective stereoinversion of a chiral phosphonyl radical is described. For individual titles, see N92-20802 through N92-20807.

N92-20802# Technische Univ., Eindhoven (Netherlands).
TOPOCHEMICALLY-DIRECTED RADICAL FORMATION. 1: QUANTITATIVE CONTROL OF THE RADICAL CONCENTRATION
Olav Marcus Aagaard, R. A. J. Janssen, B. F. M. deWaal, and H. M. Buck *In its* Topochemistry in Formation and Reactivity of Phosphorus-Centered Radicals: A Combined ESR and Theoretical Study 1991 p 13-32 Repr. from J. Am. Chem. Soc., v. 112, 1990 p 938-944 (For primary document see N92-20801 11-25)
Avail: NTIS HC/MF A09

Electron spin resonance on X-irradiated single crystals of the (2R,4S,5R) and (2S,4S,5R) diastereoisomers of 2-chloro-3,4 dimethyl 5 phenyl-1,3,2 oxazaphospholidine 2 sulfide reveal that the yield of radiogenic electron capture reactions in the solid state strongly depends on intermolecular interactions in the crystal. In the present case a high yield of P-Cl three electron bond phosphoranyl radical anions is found in crystals of the (2R,4S,5R) isomer. No radical formation can be detected for the (2S,4S,5R) isomer. An analysis of nonbonded interactions with neighboring molecules reveals that the geometry relaxation necessary for the radical stabilization is easily accommodated in crystals of the (2R,4S,5R) isomer but not in the (2S,4S,5R) isomer, explaining the observed difference in electron capture efficiency. Experiments on radical formation in a 2-MeTHF host matrix show the importance of the environment in radiogenic radical formation. The possible concurrent effect of the matrix on the electronic configuration and spin density distribution of the resulting phosphoranyl radical is discussed. ESA

N92-20803# Technische Univ., Eindhoven (Netherlands).
TOPOCHEMICALLY-DIRECTED RADICAL FORMATION. 2: QUANTITATIVE AND QUALITATIVE CONTROL OF RADICALS GENERATED IN CHIRAL DIPHOSPHINE DISULFIDES
Olav Marcus Aagaard, R. A. J. Janssen, B. F. M. deWaal, J. A. Kanters, A. Schouten, and H. M. Buck *In its* Topochemistry in Formation and Reactivity of Phosphorus-Centered Radicals: A Combined ESR and Theoretical Study 1991 p 33-77 Repr. from J. Am. Chem. Soc., v. 112, 1990 p 5432-5447 (For primary document see N92-20801 11-25)
Avail: NTIS HC/MF A09

Single crystal powder, and frozen matrix electron spin resonance experiments were performed to study the radiogenic electron capture properties of several diasteroisomeric and asymmetric diphosphine disulfides (R sub 1 R sub 2 P(S) R sub 3 R sub 4). The principal values of the hyperfine couplings of several phosphorus centered radical configurations are determined and related to the spin density distribution. Attention is focused on the strong differences in radiogenic properties, observed between the meso and racemic forms of phenyl and tolyl substituted diphosphine disulfides. X irradiation of the crystalline meso compounds MePhP(S)P(S)MePh, Me(p-Tol)P(S)P(S)Me(p-Tol), or Ph(PhCH2)P(S)P(S)Ph(CH2Ph) results in configurations in which the unpaired electron is primarily localized in one half of the molecule. X-irradiation of the corresponding racemic forms, on the other hand, gives rise to phosphoranyl radicals. The observed discrimination between symmetric and asymmetric configurations is explained. The change of van der Waals energy resulting from elongation of the P-P bond of the molecules in their respective crystal lattices was calculated. The calculations reveal stronger steric interactions for the aromatic meso compounds than for their racemic forms. X irradiation of diphosphine disulfides in a frozen THF matrix almost invariably results in a single radical product. It is concluded that in case stabilization of the initial electron adduct via P-P bond elongation is unfavorable because of steric interactions, other relaxation pathways become accessible resulting in alternative phosphoranyl radical configurations. ESA

N92-20804# Technische Univ., Eindhoven (Netherlands).
TOPOCHEMICALLY-DIRECTED RADICAL FORMATION. 3: ENANTIOSELECTIVE INVERSION OF A CHIRAL PHOSPHONYL RADICAL
B. F. M. deWall, Olav Marcus Aagaard, and R. A. J. Janssen *In its* Topochemistry in Formation and Reactivity of Phosphorus-Centered Radicals: A Combined ESR and Theoretical Study 1991 p 79-109 Submitted for publication (For primary document see N92-20801 11-25)
Avail: NTIS HC/MF A09

Electron Spin Resonance (ESR) experiments on an X-irradiated single crystal of enantiomerically pure bis(2,4,6-tri-t-butylphenyl) phosphinic chloride (1, Ar2P(O)Cl), reveal the formation of the corresponding phosphonyl radical via a dissociative electron capture reaction of the P-Cl bond. At 120K this radical exhibits an exclusive and enantioselective stereoinversion in the single crystal matrix leading to the phosphonyl radical structure 1b. This was monitored in detail using anisotropic ESR spectroscopy combined with X-ray crystallographic data. An analysis of the non bonded steric interactions demonstrates that the stereoinversion is intramolecularly controlled and occurs in a synchronous reorientation of the P-O bond and two methyl groups of the ortho-t-butyl substituents. Besides the stereoinversion, other radical reactions observed in the crystal matrix are reported. Ab initio quantum chemical calculations are employed to assess the electronic structure of the phosphonyl radical in more detail. Computation of the steric interactions encountered during stereoinversion demonstrates that the driving force of this enantioselective process is the release of strain energy within the initial phosphonyl radical. ESA

N92-20805# Technische Univ., Eindhoven (Netherlands).
TWO-CENTER THREE-ELECTRON SIGMA(*) BONDS 1. THE NATURE OF THREE-ELECTRON P-S BONDS
R. A. J. Janssen, Olav Marcus Aagaard, M. J. vanderWoerd, and H. M. Buck *In its* Topochemistry in Formation and Reactivity of Phosphorus-Centered Radicals: A Combined ESR and Theoretical Study 1991 p 111-119 Repr. from Chem. Phys. Lett., v. 171 1989 p 127-130 (For primary document see N92-20801 11-25)
Avail: NTIS HC/MF A09

An electron spin resonance study in two center three electron P-S bonds in progressively substituted trialkylphosphine sulfide phosphoranyl radicals is presented. The experiments show, in contrast with quantum chemical calculations, that the structure is not seriously affected by the electronegativity of the sulfur fragment. It is concluded that three electron bonds can be formed in condensed phases, despite an unfavorable balance of the ionization potentials of the fragments involved. ESA

N92-20806# Technische Univ., Eindhoven (Netherlands).
TWO-CENTER THREE-ELECTRON SIGMA(*) BONDS 2. RADICAL CATIONS IN MIXTURES OF Cl3P AND Me2S
Olav Marcus Aagaard, B. F. M. deWaal, M. J. T. F. Cabbolet, and R. A. J. Janssen *In its* Topochemistry in Formation and Reactivity of Phosphorus-Centered Radicals: A Combined ESR and Theoretical Study 1991 p 121-152 Submitted for publication (For primary document see N92-20801 11-25)
Avail: NTIS HC/MF A09

Exposure of mixtures of phosphorustriochloride (Cl3P) and dimethylsulfide (Me2S) dissolved in halocarbons to X-rays at 77K, results in the corresponding parent radical cations and several cation substrate adducts. The radicals are detected and identified by electron spin resonance spectroscopy. Extensive ab initio quantum chemical calculations are performed. In dilute solution exclusive formation of the Cl3P point(+) and Me2S point(+) radical cations is observed. In CFCl3, Me2S point(+) exhibits superhyperfine interactions due to chlorine and fluorine nuclei of the matrix molecule(s). At increased concentration, or on warming of the sample, the parent radical cations readily react with dissolved Cl3P or Me2S molecules, to form hodimeric and heterodimeric radical cations. On further annealing, the Cl3P-PCl3(+) cation rearranges to the well known trigonal bipyramidal Cl4P point radical and an as yet undidentified configuration. Candidates for the latter are proposed. In concentrated frozen solutions a reaction results in a heteotrimer with an octahedral configuration, exhibiting a very large P-31 hyperfine interaction. Calculations including isotropic and dipolar electron nulcear hyperfine interactions, confirm the assignments and provide detailed insight into the molecular

geometries, electronic configurations and stability of the radical products. ESA

N92-20807# Technische Univ., Eindhoven (Netherlands).
TWO-CENTER THREE-ELECTRON SIGMA(*) BONDS 3. INTRA- OR INTERMOLECULAR RADIOGENIC P-P SIGMA(*) RADICALS FROM BIS(DIPHENYLPHOSPHINO) DERIVATIVES
R. A. J. Janssen, Olav Marcus Aagaard, M. J. T. F. Cabbolet, and B. F. M. deWaal *In its* Topochemistry in Formation and Reactivity of Phosphorus-Centered Radicals: A Combined ESR and Theoretical Study 1991 p 153-176 Submitted for publication (For primary document see N92-20801 11-25)
Avail: NTIS HC/MF A09

A matrix electron spin resonance study in radiogenic radical cations of Ph2P-R-PPh2 derivatives with various linkers (R) is presented. The experiments show that in a frozen dichloromethane solution the radical cations can adopt localized, cyclic, and dimeric configurations, depending on the nature of the linker. The cyclic and dimeric products are formed in the reaction of a localized cation with a second free electron pair, resulting in respectively an intra and intermolecular three-electron bond. The formation of the cyclic structure, possessing a strongly bent intra and intermolecular three electron bond, requires a specific proximate orientation of the two phosphine moieties in the precursor molecule. The mutual conformation of the two free electron pairs of the precusors is assessed. Ab initio unrestricted Hartree-Fock quantum chemical calculations performed support assignments, and give a detailed insight into the radical cation structures. ESA

N92-20873# Army Lab. Command, Fort Monmouth, NJ. Electronics Technology and Devices Lab.
ULTRAVIOLET-OZONE CLEANING OF SEMICONDUCTOR SURFACES
John R. Vig Jan. 1992 44 p
(DA Proj. 1L1-62705-AH-94)
(AD-A245102; SLCET-TR-91-33) Avail: NTIS HC/MF A03
CSCL 07/2

The ultraviolet (UV)/ozone surface-cleaning method, which is reviewed in this report, is an effective method of removing a variety of contaminants from silicon (as well as many other) surfaces. It is a simple-to-use dry process which is inexpensive to set up and operate. It can rapidly produce clean surfaces, in air or in vacuum system, at ambient temperatures. In combination with a dry method for removing inorganic contamination, the method may meet the requirements for the all-dry cleaning methods that will be necessary for future generations of semiconductor devices. Placing properly precleaned surfaces within a few millimeters of an ozone-producing UV source can produce clean surfaces in less than one minute. The technique can produce near-atomically clean surfaces, as evidenced by Auger electron spectroscopy, ESCA, and ISS/SIMS studies. Topics discussed include the variables of the process, the types of surfaces which have been cleaned successfully, the contaminants that can be removed, the construction of an UV/ozone cleaning facility, the mechanism of the process, UV/ozone cleaning in vacuum systems, rate-enhancement techniques, safety considerations, effects of UV/ozone other than cleaning, and applications. GRA

N92-20930# Rolls-Royce Ltd., Derby (England).
TURBULENT COMBUSTION MODELLING: A REVIEW
C. H. Pridden 1 Nov. 1990 21 p
(PNR-90784; ETN-92-90770) Copyright Avail: NTIS HC/MF A03

A brief description of methods available to model turbulent combustion problems is given. It is shown that the classification of flames by Damkohler number is of limited use and is difficult to apply. For the case of gas turbine combustion, while high power operation can be simulated effectively by simple combustion models, low power simulations require the use of more detailed kinetic schemes and the coupling of these to the turbulence. Transport methods for the probability density function seem to offer the best prospect of achieving this but require more research to be of use in practical situations. ESA

N92-20946# Farrington Lockwood Co. Ltd., Kanata (Ontario).
CHEMICAL AND THEORETICAL STUDY OF ANODE-LIMITED LITHIUM-SULPHUR DIOXIDE ELECTROCHEMISTRY Final Report
Tim J. Patraboy, Simon F. Jones, James S. Anderson, and Jeffrey C. Whyte 30 Nov. 1990 116 p Sponsored by National Defence Headquarters
(CTN-92-60442) Avail: NTIS HC/MF A06

Severe events including thermal runaway and explosions have occurred during discharge of Li/SO2 cells whose anodes were damaged by vibration. A study was conducted to explain this hazardous behavior, employing both vibrationally damaged commercial cells and model cells designed to simulate the damaged cells. In both types of cells, the cell voltage exhibited an unsteady discharge profile. The fluctuations were attributed to processes involving the anodic lithium. A significant hazard was observed when a model cell was driven into voltage reversal. A deposit of finely divided lithium was found on the surface of the bulk lithium immediately adjacent to the anode weld site. Signs of lithium oxidation toward the center of the cells was also observed, suggesting a process in which anodic lithium is oxidized from the can and deposited on the surface of the bulk lithium immediately adjacent to the anode. The hazardous behavior appears to be initiated by intermittent contacts between the bulk lithium and the anode. These contacts are believed to occur when dendrites growing on the bulk lithium surface penetrate the separator and contact the anode or its remains. Periodically resistive heating may cause the dendritic contacts to melt, generating transient local hot spots which may initiate a reaction of the lithium deposit. Author (CISTI)

N92-20991# Argonne National Lab., IL.
ANALYSIS OF SMALL ANGLE SCATTERING DATA BY MODEL FITTING
J. E. Epperson and D. J. Johnson Jan. 1992 13 p Presented at the Minerals, Metals, and Materials Society (TMS) Annual Meeting and Exhibition, San Diego, CA, 1-5 Mar. 1992
(Contract W-31-109-eng-38)
(DE92-007367; ANL/CP-73833; CONF-920305-4) Avail: NTIS HC/MF A03

Small angle scattering is a common technique for investigating fluctuations in materials, for sizes ranging from about ten to a few hundred Angstroms. The technique could be more widely used if data analyses were more convenient; however, expressions relating the small angle scattered intensity to materials parameters of interest tend to be complicated. Non-linear regression fitting of experimental small angle scattering data from metallurgical systems is discussed, and the analysis procedure is demonstrated for two models on data from a Ni-Si alloy undergoing phase separation. It is concluded that if sufficient information is available to permit the proper model to be identified, quantitative values for the relevant materials parameters can be extracted in a rather routine manner, provided the parameters are not too closely coupled. DOE

N92-20999# Sandia National Labs., Albuquerque, NM.
ENHANCEMENT OF SOLAR PHOTOCATALYTIC DETOXIFICATION BY ADSORPTION OF PORPHYRINS ONTO TiO2
S. A. Majumder, M. R. Ondrias, M. R. Prairie, and J. A. Shelnutt 1991 10 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-000243; SAND-91-1856C; CONF-920436-4) Avail: NTIS HC/MF A02

Titanium dioxide (TiO2) is a photocatalyst for solar detoxification of water containing organic contaminants such as solvents, PCB's, dioxins, pesticides, and dyes. Unfortunately, the ultraviolet (UV) energy used by TiO2 (lambda less than 400 nm) only comprises about 4 percent of the solar spectrum. One way of enhancing the efficiency of solar detoxification technologies is to utilize a larger portion of the solar spectrum to initiate the TiO2-catalyzed detoxification chemistry. Metalloporphyrins strongly absorb visible and near infrared radiation. By utilization of a process called

photosensitization, adsorption of these dyes onto TiO2 can enable a much broader portion of the solar spectrum to be used. Photosensitization relies upon the ability of the dye molecule to absorb more of the solar energy than bare TiO2 and to interact electronically with the TiO2 surface in such a way as to initiate TiO2-based redox photochemistry using the dye-absorbed energy. DOE

N92-21011# Emory Univ., Atlanta, GA.
NEW MODES OF CATALYSIS AND REACTIVITY Report, 1 Sep. 1988 - 31 Aug. 1991
F. M. Menger 4 Aug. 1991 4 p
(Contract DAAL03-88-K-0193)
(AD-A244481) Avail: NTIS HC/MF A01 CSCL 15/6

There are two separate phases to the project funded by the ARO for the past three years: (1) New copper-containing polymers were synthesized for the purpose of hydrolyzing phosphorus (V) derivatives including nerve agents. These polymers were characterized by high surface area and high surface functionalization. (2) New microemulsion systems were developed to oxidatively destroy mustards. It was found that certain microemulsions could detoxify half-mustard faster than we could measure the rate (i.e. less than 15 seconds). The method is mild, simple, cheap, and selective. A 15 ml sample of microemulsion can destroy as much as 1 ml of mustard simulant. No continuous stirring, photolysis, or other impediment for use in the field is required. It is argued that the methodology has considerable potential for practical applications. GRA

N92-21058# Sandia National Labs., Albuquerque, NM.
HIGH RATE HEATING DRIVEN DECOMPOSITION OF ENERGETIC MATERIALS: DIAGNOSTICS EVALUATION
W. M. Trott, A. M. Renlund, K. L. Erickson, and R. D. Skocypec 1991 10 p Presented at the 28th Joint Army/Navy/NASA/Air Force (JANNAF) Combustion Subcommittee Meeting, San Antonio, TX, 28 Oct. - 1 Nov. 1991
(Contract DE-AC04-76DP-00789)
(DE92-003642; SAND-91-2301C; CONF-9110288-1) Avail: NTIS HC/MF A02

Combustion of energetic materials involves processes in both gas and condensed phases and is governed by coupled thermal, physical, and chemical phenomena. Development of reliable models for design, performance, stability, and hazard analyses requires detailed understanding of three general chemical reaction regimes: (1) initial condensed-phase decomposition; (2) subsequent interaction of decomposition products with the remaining condensed phase; and (3) gas-phase reaction of decomposition products to form the ultimate combustion products. The first two regimes are the least understood and most difficult to study, particularly the initial condensed-phase decomposition. The basic difficulty in studying condensed phase phenomena has been the inability to directly probe chemistry in the condensed phase under isothermal conditions with the spatial and temporal resolution needed at higher temperatures and reaction rates. Thin-film samples provide a means to study condensed-phase chemistry at isothermal conditions with microsecond temporal resolution. We are developing an experiment system that employs rapidly heated thin-film samples and multiple diagnostics to examine condensed-phase chemistry and monitor evolved gas species. Results from our initial work have been encouraging. Thin-film samples of several energetic materials have been prepared and appear to be representative of bulk materials. Furthermore, preliminary experiments indicate that all use of these samples with two chemical diagnostic techniques, time-of-flight mass spectrometry (TOFMS) and time-resolved infrared spectral photography (TRISP), is viable. DOE

N92-21061# Pennsylvania Univ., Philadelphia.
UNIMOLECULAR AND BIMOLECULAR REACTIONS INDUCED BY STATE-SPECIFIC VIBRATIONAL EXCITATION
Hai-Lung Dai Nov. 1991 6 p
(Contract DE-FG02-86ER-13584)
(DE92-003693; DOE/ER-13584/T1) Avail: NTIS HC/MF A02

Toward the goal of understanding the role of vibrational energy in chemical reactions related to energy production, we have made several advances. They include the understanding of chemical properties of highly vibrationally excited molecules, the characterization of vibrationally excited radicals, and the development of experimental techniques to extend our ability to investigate transient and reactive chemical species. DOE

N92-21068# Pennsylvania State Univ., University Park. Dept. of Chemistry.
HIGHLY NUCLEOPHILIC ACETYLIDE, VINYL, AND VINYLIDENE COMPLEXES
1 Aug. 1991 7 p
(Contract DE-FG02-85ER-13323)
(DE92-003751; DOE/ER-13323/6) Avail: NTIS HC/MF A02

In the past year we have completed our studies of the halide-promoted carbonylation of imido ligands, extended our explorations of Cp(CO)(L)Mn-X complexes which possess highly reactive acetylide, vinylidene, carbyne, and vinylcarbyne ligands, and have briefly investigated the formation of bimetallic complexes using anionic carbene complexes. DOE

26 METALLIC MATERIALS

Includes physical, chemical, and mechanical properties of metals, e.g., corrosion; and metallurgy.

N92-20063*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
LONG-TERM LIFE TESTING OF GEOSTATIONARY OPERATIONAL ENVIRONMENTAL SATELLITE (GOES) ENCODER LAMPS
Charles E. Powers Feb. 1992 120 p
(NASA-RP-1273; Rept-92B00013; NAS 1.61:1273) Avail: NTIS HC/MF A06 CSCL 11F

The aging characteristics and lifetimes of tungsten filament encoder lamps were determined as a function of operating voltage and filament material. For pure tungsten and thoria doped (1 pct.) filament lamps, crystal grain growth over the center portion of the filament leads to the ultimate failure of the lamp. The development of notches associated with this grain growth is the cause of lamp burn out. Eventually, one of the notches will 'etch' through the filament, causing it to fail open. For rhenium doped (3 pct.) filament lamps, distortion of the filament leads to the ultimate failure of the lamp. The lifetime of these lamps is about 1 year at an operating voltage of 5.0 volts. The pure tungsten filament lamps have the longest average lifetime, and the thoria doped filament lamps have the shortest at 5.0 volts. The lifetimes of these lamps is about 7 years at an operating voltage of 3.5 volts. Data suggest that the rhenium doped lamps will have the longest average lifetime at 3.5 volts, and the thoria doped will have the shortest. These lifetimes are comparable to the desired lifetimes of 7 years. Author

N92-20092# Pacific Northwest Lab., Richland, WA.
HIGH SWELLING RATES OBSERVED IN NEUTRON-IRRADIATED V-Cr AND V-Si BINARY ALLOYS
F. A. Garner, D. S. Gelles, H. Takahashi, S. Ohnuki, H. Kinoshita, and B. A. Loomis (Argonne National Lab., IL.) Nov. 1991 14 p Presented at the International Conference on Fusion Reactor Materials, Clearwater, FL, 17-22 Nov. 1991
(Contract DE-AC06-76RL-01830)
(DE92-006479; PNL-SA-19559; CONF-911111-28) Avail: NTIS HC/MF A03

Additions of 5 to 14 wt percent chromium to vanadium lead to very large swelling rates during neutron irradiation of the binary alloys, with swelling increasing strongly at higher irradiation temperatures. Addition of 2 wt percent silicon to vanadium also leads to very large swelling rates but swelling decreases with increasing irradiation temperature. Addition of 1 wt percent zirconium does not yield high swelling rates, however. DOE

N92-20095# Ames Lab., IA.
CONSUMABLE ELECTRODE ARC CASTING OF COPPER-REFACTORY METAL COMPOSITES
L. L. Jones, F. A. Schmidt, and J. D. Verhoeven 1991 13 p Presented at the Annual Meeting and Exhibition of the Minerals, Metals and Materials Society (TMS), New Orleans, LA, 17-21 Feb. 1991
(Contract W-7405-eng-82)
(DE92-006587; IS-M-692; CONF-910202-20) Avail: NTIS HC/MF A03

Consumable electrode arc casting has been developed as a preparation method for producing high strength/high electrical and thermal conductivity metal-metal matrix composites. Electrode configuration and melting parameters have been studied to improve ingot homogeneity. Alloy ingot impurities have been reduced by a combination of mold material and melting practice. Alloys containing 15 to 20 vol. pct. Cr, Mo, Nb, Ta, and V have been prepared. Strengths of 150 to 300 ksi were produced in deformation processed Cu-Nb sheet and wire. Significant differences in strengthening between the sheet and wire are attributed to filament morphology which is related to the deformation mode. Cold axisymmetric deformations of 99.999 pct. reduction in area have been achieved with axisymmetric deformation providing the highest strengthening. DOE

N92-20096# Oak Ridge National Lab., TN.
HEAT TREATMENT EFFECTS ON TOUGHNESS OF 9Cr-1MoVNb AND 12Cr-1MoVW STEELS IRRADIATED AT 365 C
R. L. Klueh and D. J. Alexander 1991 14 p Presented at the International Conference on Fusion Reactor Materials, Clearwater, FL, 17-22 Nov. 1991
(Contract DE-AC05-84OR-21400)
(DE92-006592; CONF-911111-32) Avail: NTIS HC/MF A03

The 9Cr-1MoVNb and 12Cr-1MoVW steels were austenitized at 1040 and 1100 C to produce different prior austenite grain sizes, after which they were given different tempering treatments (1 h at 760 or 2.5 h at 780 C). Subsize Charpy impact specimens from these materials were irradiated at 365 C up to 5 dpa. For 9Cr-1MoVNb steel in the unirradiated condition, the smaller the prior austenite grain size and the higher the tempering temperature, the lower the ductile-brittle transition temperature (DBTT). Regardless of the DBTT in the unirradiated condition, however, the DBTT shift for 9Cr-1MoVNb steel due to irradiation was the same for all heat treatments. This means heat treatment can be used to ensure a lower DBTT before and after irradiation. The 12Cr-1MoVW steel showed little effect of heat treatment on DBTT in the unirradiated condition, and the shift in DBTT was relatively constant. Thus, it appears that heat treatment cannot be used to reduce the effect of irradiation on DBTT for this steel. DOE

N92-20125# Oak Ridge National Lab., TN.
MULTIPLE ION IMPLANTATION EFFECTS ON HARDNESS AND FATIGUE PROPERTIES OF Fe-13Cr-15Ni ALLOYS
G. R. Rao, E. H. Lee, L. A. Boatner, L. K. Mansur, and B. A. Chin (Auburn Univ., AL.) 1991 18 p Presented at the International Conference on Fusion Reactor Materials, Clearwater, FL, 17-22 Nov. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005473; CONF-911111-19) Avail: NTIS HC/MF A03

Eight complex alloys based on the composition Fe-13Cr-15Ni-2Mo-2Mn-0.2Ti-0.8Si-0.06C were implanted simultaneously with 400 keV boron and 550 keV nitrogen, and investigated for microhardness changes and bending fatigue life. The dual implantation was found to decrease the fatigue life of all eight alloys although the implantation increased near-surface hardness of all eight alloys. This result was in contrast to the significant improvements found in the fatigue life of four B and N implanted simple Fe-13Cr-15Ni alloys. It was determined that the implantation suppressed surface slip-band formation, the usual crack initiation site, but in the complex alloys, this suppression promoted a shift to grain boundary cracking. A similar phenomenon was also observed when the simple Fe-13Cr-15Ni alloys were simultaneously implanted with boron, nitrogen, and carbon wherein fatigue life decreased, and again, grain boundary cracks were observed. To test the hypothesis that ion implantation made the overall surface more fatigue-resistant but led to a shift to grain-boundary cracking, single crystal specimens of the ternary Fe-15Cr-15Ni were also implanted with boron and nitrogen ions. The fatigue life decreased for the single-crystal specimens also, due to concentration of applied stress along fewer slip bands as compared to the control single crystal specimens where applied stress was relieved by slip band formation over the entire gauge region. Fatigue life improvement by ion implantation at intermediate strain levels has a sensitive dependence on grain size as well as extent of slip band suppression. DOE

N92-20145# Oak Ridge National Lab., TN.
MECHANICAL PROPERTIES OF ADVANCED NICKEL ALUMINIDES
D. J. Alexander and V. K. Sikka 1991 23 p Presented at the International Conference on High Temperature Aluminides and Intermetallics, San Diego, CA, 17-19 Sep. 1991
(Contract DE-AC05-84OR-21400)
(DE92-006853; CONF-910938-8) Avail: NTIS HC/MF A03

The mechanical properties of two nickel aluminide alloys have been studied over a range of temperatures. Testing included tensile, impact, and fracture toughness testing. The wrought alloy was studied in cold-worked and cold-worked plus annealed conditions. The cast alloy was studied in the as-cast condition. At room temperature, the annealed wrought alloy showed good tensile properties and fracture toughness. The cold-worked material had much higher strength, but the fracture toughness was reduced. At 650 C both the cold-worked and the annealed conditions showed reduced toughness. The cast alloy showed acceptable tensile properties and fracture toughness at room temperature, and good tensile properties at 650 C. However, the fracture toughness was reduced at the higher temperature. Impact testing showed relatively little effect of temperature intergranular fracture for the wrought alloy, and interdendritic fracture for the cast material were found to be responsible for the low toughness observed at 650 C. The availability of oxygen to the freshly exposed metal at the strained crack tip is believed to cause oxygen embrittlement of the grain boundaries, and thus intergranular fracture for the wrought alloy, and interdendritic failure for the cast material. DOE

N92-20164# Rolls-Royce Ltd., Derby (England).
PRESENT AND FUTURE TRENDS IN TURBINE BLADE MATERIAL AND MANUFACTURING TECHNOLOGY
G. J. S. Higginbotham and D. A. Ford 1 Nov. 1990 10 p Repr. from Materials and Design, v. 11, no. 5, Oct. 1990 p 247-255 Presented at European Investment Casting Federation, Lugano, Italy, Jun. 1990
(PNR-90825; ETN-92-90847) Copyright Avail: NTIS HC/MF A02

A review of Directionally Solidified (DS) and Single Crystal (SC) casting technology is given and the development of a successful industrial process and subsequent engine testing is outlined. A look ahead to some of the challenges for the future is made and further required development is outlined. ESA

N92-20165# Rolls-Royce Ltd., Derby (England).
MODELLING OF HEAT TREATMENT PROCESSES AND PREDICTION OF RESIDUAL STRESSES
I. W. Craighead and O. L. Towers 4 Oct. 1990 9 p
(PNR-90866; ETN-92-90852) Copyright Avail: NTIS HC/MF A02

A technique for predicting residual stresses due to oil quenching in gas turbine components using the Finite Element Method (FEM) is described. Supporting experimental work on a nickel base superalloy turbine disc is also described. The experimental program consisted of two phases, the first to record the temperatures as a model disc was quenched in oil, the second to measure the residual stresses induced on the component by the quenching process. The results show that the FEM based analysis technique can be

used to predict residual stresses to within the accuracy of experimental measurements. ESA

N92-20176# Rolls-Royce Ltd., Derby (England).
METHODING AND NUMERICAL MODELING OF LIGHT ALLOY CAST COMPONENTS
J. C. Hogg 1 Jan. 1991 12 p
(PNR-90849; ETN-92-90799) Copyright Avail: NTIS HC/MF A03

In the last decade significant developments have been made in light alloy foundry processes. Among the significant developments are the following: manufacturing routes, binder systems, and process control monitors. These developments have contributed greatly to the effectiveness of all those foundries which have applied these new technologies. The next significant area of development for the light alloy foundry is the application of mathematical modeling as a tool for the placing of runner, feeders, and chills to minimize or eliminate the risk of casting defects. The modeling techniques currently available (software packages) rely on one of two methods for their solution. The techniques are Finite Difference Method (FDM) or Finite Element Method (FEM), and it is these numerical methods which can be applied with success to the light alloy casting process. The techniques are currently being developed and validated by various industrial and commercial software houses for direct application to the light alloy industry. A brief description of what is available to the foundry is given together with a route for the implementation of these models. ESA

N92-20209# National Inst. of Standards and Technology, Gaithersburg, MD. Metallurgy Div.
MECHANICAL PROPERTIES AND FRACTURE TOUGHNESS OF AAR TC128 GRADE B STEEL IN THE NORMALIZED, AND NORMALIZED AND STRESS RELIEVED CONDITIONS
George E. Hicho and Donald E. Harne Sep. 1991 46 p
Sponsored by Federal Railroad Administration
(PB92-108901; NISTIR-4660; Rept-24) Avail: NTIS HC/MF A03 CSCL 11F

Traditional mechanical property tests, ultimate and yield strength, reduction in area, elongation, impact, and the nil-ductility temperature were performed on AAR TC128 grade B steel in the normalized, and the normalized and stress relieved conditions from -51 C to room temperature. In addition, the crack initiation fracture toughness, as a function of temperature, was determined. It was found that the normalized and stress relieved steel had overall better mechanical and fracture toughness properties than the normalized steel. Author

N92-20218# Sandia National Labs., Albuquerque, NM.
FLUXLESS SOLDERING USING ACTIVATED ACID VAPORS
D. R. Frear and D. M. Keicher 1992 12 p Presented at the National Electronics Products Conference (NEPCON) West, Anaheim, CA, 23-27 Feb. 1992
(Contract DE-AC04-76DP-00789)
(DE92-005455; SAND-91-2743C; CONF-920247-4) Avail: NTIS HC/MF A03

Acid vapors have been used to fluxlessly reduce metal oxides and enhance wetting of solder on metallizations. Dilute solutions of hydrogen, acetic acid and formic acid in an inert carrier gas of nitrogen or argon were used with the sessile drop technique for 60Sn-40 Pb solder on Cu and Au/Ni metallizations. The time to reduce metal oxides and the extent of wetting as a function of acid vapor concentrations were characterized. Acetic and formic acids reduce the surface metal oxides sufficiently to form metallurgically sound solder joints. Hydrogen did not reduce oxides rapidly enough at 220 C suitable for soldering applications. The optimum conditions for oxide reduction with formic acid was with an acid vapor concentration in nitrogen nitrogen carrier gas of 4 pct. for Cu metallizations on Au/Ni. The acetic acid vapor concentration, also in nitrogen, was optimized at 1.5 pct. for both metallizations. Above a vapor concentration of 1.5 pct., the acetic acid combined with the bare metal to form acetates which increased the wetting time. These results indicate that acid vapor fluxless soldering is a viable alternative to traditional flux soldering. DOE

N92-20403# Iowa Univ., Iowa City. Dept. of Chemistry.
SYNTHESIS AND CHEMISTRY OF CATIONIC D(SUP 0) METAL ALKYL COMPLEXES
R. F. Jordan 1991 29 p
(Contract DE-FG02-88ER-13935)
(DE92-005300; DOE/ER-13935/3) Avail: NTIS HC/MF A03

The objective of this project is to develop new types of electrophilic metal alkyl complexes for catalytic C-H activation and olefin polymerization chemistry, and associated fundamental mechanistic studies. We have focused our efforts on four classes of early metal alkyl complexes: (1) cationic group 4 Cp2M(R)(+) complexes (1) which are active species in Cp2MX2-based Ziegler-Natta olefin polymerization catalyst systems and which catalyze productive C-H activation reactions of heterocycles, (2) neutral (dicarbollide)(Cp*)M(R) complexes (2) which are structurally are electronically very similar to 1, (3) half-sandwich complexes CpM(R)2(L)(sub n)(+) which are highly coordinatively and electronically unsaturated, and (4) new group 5 (dicarbollide)(Cp)MR2 and (dicarbollide)2 MR complexes which are more unsaturated than group 5 Cp2M systems due to incorporation of the dicarbollide ligand. DOE

N92-20438# Brookhaven National Lab., Upton, NY.
XANES STUDIES OF CHROMATE REPLACEMENTS IN OXIDE FILMS ON ALUMINUM
A. J. Davenport, A. J. Aldykiewicz, Jr., H. S. Isaacs, M. W. Kendig, and A. M. Mundy 1991 9 p Presented at the 180th Meeting of the Electrochemical Society, Phoenix, AZ, 13-18 Oct. 1991
(Contracts DE-AC02-76CH-00016; DE-FG05-89ER-45384)
(DE92-007176; BNL-47017; CONF-911047-13) Avail: NTIS HC/MF A02

The chemistry of conversion coatings on aluminum containing chromate and non-toxic chromate replacements has been investigated using XANES. Chromate conversion coatings contain 20 percent 6-valent chromium which is gradually lost on immersion in a corrosive environment. The most promising alternative coatings are those based on phosphotungstate. The chemistry of these and coatings containing Mo, V, and Mn are discussed. DOE

N92-20462# GKSS-Forschungszentrum Geesthacht (Germany, F.R.). Inst. fuer Werkstofforschung.
DEFORMATION BEHAVIOUR OF A LAMELLA-FREE DUAL-PHASE GAMMA-BASE TITANIUM ALUMINIDE ALLOY
M. Dahms, T. Pfullmann (Technische Univ., Hamburg, Germany, F.R.), J. Seeger, and B. Wildhagen 1991 12 p Presented at the 1990 TMS Fall Meeting, Detroit, MI, 7-11 Oct. 1990
(GKSS-91/E/19; ISSN-0344-9629; ETN-92-91009) Copyright Avail: NTIS HC/MF A03

An elemental powder mixture of composition Ti-36 wt percent Al was cold extruded and subsequently reactive hot isostatic pressed at 1100 C. A dual phase microstructure was formed with elongated islands of Ti3Al within a TiAl matrix. Samples were tested in compression at temperatures between 400 and 900 C. The material exhibits good deformability at 700 C and above. In this region, the typical stress strain behavior for dynamic recrystallization is observed. Both phases undergo deformation. Below 700 C, pseudoplasticity occurs which is related to homogenous formation of microcracks. ESA

N92-20467# Helsinki Univ. of Technology, Espoo (Finland). Low Temperature Lab.
NUCLEAR MAGNETISM IN METALS: NEUTRON DIFFRACTION EXPERIMENTS ON COPPER AND NMR MEASUREMENTS ON SILVER Ph.D. Thesis
Arto Annila 1991 54 p Sponsored by Finnish Cultural Foundation; Magnus Ehrnrooth Foundation; Academy of Finland; and Danish Research Academy
(ETN-92-91018) Avail: NTIS HC/MF A04

The second phase of neutron diffraction experiments on copper and the first NMR (Nuclear Magnetic Resonance) measurements

on antiferromagnetism in silver are presented. The similarities and differences between the two nuclear spin systems are discussed. Susceptibility measurements on copper are reviewed. The application of the neutron diffraction technique to studies of nuclear magnetic ordering is explained and data are described. Contemporary understanding of the phase diagram of copper, the spin structures based on recent theoretical calculations, is presented. Interesting questions remaining in the research of nuclear magnetic ordering in copper and silver are discussed in conclusion. ESA

N92-20556# Welding Consultants, Inc., Columbus, OH.
THE METAL-LAX METHOD OF STRESS REDUCTION IN WELDS
1991 40 p
(Contract DE-FG01-89CE-15412)
(DE92-004945; DOE/CE-15412/T3) Avail: NTIS HC/MF A03

The preliminary project to evaluate the possibility of replacing or reducing thermal stress relief and preheat with sub-resonant vibration has been completed. Bonal Technologies manufactures the Meta-Lax system of sub-resonant vibration for use in industry and has met with success on many occasions. The uses are varied and cross into many industries, including fabrication, foundries, and marine construction. However, the specific engineering or scientific basis for the successes has proven to be very elusive. The purpose of this preliminary evaluation of the Meta-Lax system was to try and determine what is happening when sub-resonant vibration is introduced during and/or after welding operations. The final goal is to determine if this process can replace or reduce thermal stress relief and preheat now required on many welded assemblies. The potential savings could be enormous. DOE

N92-20562# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne (Germany, F.R.). Inst. fuer Raumsimulation.
NONEQUILIBRIUM SOLIDIFICATION OF UNDERCOOLED METALLIC MELT Thesis - Ruhr Univ.
Dieter M. Herlach May 1991 125 p In GERMAN; ENGLISH summary
(DLR-FB-91-20; ISSN-0939-2963; ETN-92-90737) Avail: NTIS HC/MF A06; DLR, Wissenschaftliches Berichtswesen, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC 45 DM

The present state of the art is reviewed, with regard to the nonequilibrium state of an undercooled melt allowing investigation of various phenomena involved in the formation of metastable solid phases. The thermodynamics of the undercooled melt, the nucleation and growth processes are discussed, with special emphasis on the conditions of the formation of metastable states, such as metastable crystalline metals, quasicrystals, metallic glasses, supersaturated solutions and grain refined materials. The different techniques applied to undercooled metallic systems by substantial amounts, even at low cooling rates are described. Aspects of microgravity research in this field are included. ESA

N92-20569# Southwest Research Inst., San Antonio, TX.
APPLICATION OF MAGNETOMECHANICAL HYSTERESIS MODELING TO MAGNETIC TECHNIQUES FOR MONITORING NEUTRON EMBRITTLEMENT AND BIAXIAL STRESS
M. J. Sablik, H. Kwun, W. L. Rollwitz, and D. Cadena 1 Jan. 1992 58 p
(Contract DE-FG05-91ER-14180)
(DE92-005519; DOE/ER-14180/1) Avail: NTIS HC/MF A04

The objective is to investigate experimentally and theoretically the effects of neutron embrittlement and biaxial stress on magnetic properties in steels, using various magnetic measurement techniques. Interaction between experiment and modeling should suggest efficient magnetic measurement procedures for determining neutron embrittlement biaxial stress. This should ultimately assist in safety monitoring of nuclear power plants and of gas and oil pipelines. In the first six months of this study, magnetic measurements were made on steel surveillance specimens from the Indian Point 2 and D.C. Cook 2 reactors. The specimens were previously characterized by Charpy tests after specified neutron fluences. The following measurements are included: (1) hysteresis loop measurement of coercive force, permeability, and remanence; (2) Barkhausen noise amplitude; and (3) higher order nonlinear harmonic analysis of a 1 Hz magnetic excitation. Good correlation of magnetic parameters was found for specimens from the Indian Point 2 reactor. The D.C. Cook 2 specimens, however, showed poor correlation. Possible contributing factors to this are: (1) metallurgical differences between D.C. Cook 2 and Indian Point 2 specimens; (2) statistical variations in embrittlement parameters for individual samples away from the stated mean values; and (3) conversion of the D.C. Cook 2 reactor to a low leakage core configuration in the middle of the period of surveillance. Modeling using a magnetomechanical hysteresis model has begun. The modeling will first focus on why Barkhausen noise and nonlinear harmonic amplitudes appear to be better indicators of embrittlement than the hysteresis loop parameters. DOE

N92-20571# Pacific Northwest Lab., Richland, WA.
HELIUM GENERATION RATES IN ISOTOPICALLY TAILORED Fe-Cr-Ni ALLOYS IRRADIATED IN FFTF/MOTA
L. R. Greenwood, F. A. Garner, and B. M. Oliver (Rockwell International Corp., Canoga Park, CA.) Nov. 1991 11 p Presented at the International Conference on Fusion Reactor Materials, Clearwater, FL, 17-22 Nov. 1991
(Contract DE-AC06-76RL-01830)
(DE92-006421; PNL-SA-19318; CONF-911111-20) Avail: NTIS HC/MF A03

Three Fe-Cr-Ni alloys were doped with 0.4 percent Ni-59 for side-by-side irradiations of doped and undoped materials in order to determine the effects of fusion-relevant levels of helium production on microstructural development and mechanical properties. The alloys were irradiated in three successive cycles of the Materials Open Test Assembly (MOTA) located in the Fast Flux Test Facility (FFTF). Following irradiation, helium levels were measured by isotope dilution mass spectrometry. The highest level of helium achieved in doped alloys was 172 appm at 9.1 dpa for a helium(appm)-to-dpa ratio of 18.9. The overall pattern of predicted helium generation rates in doped and undoped alloys is in good agreement with the helium measurements. DOE

N92-20827# Ohio State Univ., Columbus.
A FUNDAMENTAL INVESTIGATION INTO THE JOINING OF ADVANCED LIGHT MATERIALS Final Report, Apr. 1988 - Oct. 1991
W. A. Baeslack, III and L. Adler 25 Nov. 1991 290 p
(Contract DAAL03-88-K-0049)
(AD-A244788; ARO-25373.10-MS) Avail: NTIS HC/MF A13 CSCL 11/6

Research performed during this program investigated the fundamental, materials science aspects of joining advanced light materials, emphasizing the similar and dissimilar alloy joining of state of the art dispersion-strengthened, elevated-temperature aluminum alloys, weld solidification/segregation effects on solid-state phase transformations in aluminum--copper and aluminum--copper lithium type alloys, and the application of advanced ultrasonic NDE techniques to evaluate the characteristics and quality of solid-phase welds between light materials. The pulsed Nd:YAG laser welding process was shown to be highly effective in producing high-integrity fusion welds in a low-hydrogen content Al--8Iron--2Molybdenum alloy. Detailed analytical-electron microscopy analysis showed that the extremely high solidification and cooling rates experienced during this process promoted the formation of a microstructurally refined, high-strength fusion zone microstructure, and that minimal dispersoid coarsening occurred in the weld heat-affected zone (HAZ). Transverse-weld oriented tensile joint efficiencies of essentially 100 percent were measured. Longitudinal-weld oriented bend testing showed excellent weld zone ductility with fracture occurring in the HAZ within the fusion zone of a previous pulse. GRA

N92-20831# Department of the Navy, Washington, DC.
METHOD OF FORMING NANOMETER-SCALE TRENCHES AND VIAS Patent Application
David S. Hsu, inventor (to Navy) and Henry F. Gray, inventor (to Navy) 24 Oct. 1991 22 p
(AD-D015180; US-Patent-Appl-SN-782197) Avail: NTIS HC/MF A03 CSCL 09/1

Nanometer thick metallic layers are fabricated on trenches or holes (especially vias) within a substrate by depositing, by thermal decomposition of a volatile metal-containing precursor gas in the presence of a carrier gas at low pressure, a metallic layer on a substrate surface on which one or more trenches or holes are formed. The metallic layer thus formed has an extremely small grain size, which permits the attainment of very high spatial resolution and thus permits the formation of extremely small trenches and holes, increasing the attainable memory/circuit density. This invention is useful in the fabrication of ultra-high density trench capacitors and ultra-large scale integrated microelectronic circuits. Author (GRA)

N92-20836# Department of the Navy, Washington, DC.
PROCESS FOR MAKING SUPERPLASTIC STEEL POWDER AND FLAKES Patent Application
Jack D. Ayers, inventor (to Navy) 15 Nov. 1991 17 p
(AD-D015183; US-Patent-Appl-SN-787994) Avail: NTIS HC/MF A03 CSCL 11/6

In a process for making superplastic steel powder or flakes, molten steel is rapidly solidified to form a solidified material comprising substantially single-phase austenitic steel powder or flakes having a grain size of no greater than about 2 microns. The powder or flakes are heated at a temperature of 300 C to 600 C to produce superplastic steel comprising a mixture of ferrite steel and at least one metal carbide, the ferrite steel having a randomly oriented structure and having a grain size of no greater than about 2 microns, and the one metal carbide having a grain size no greater than about 0.5 microns. The steel powder or flake is then recovered for further processing. A consolidated superplastic steel can be formed from the powder or flake by hot pressing the powder or flake at a temperature of between about 650 C and about 950 C and at a pressure of about 10 MPa to about 100 MPa for a time sufficient to form a fully dense consolidate. GRA

N92-20852# California Univ., Berkeley. Lawrence Berkeley Lab.
ACTIVATION OF CARBON-HYDROGEN BONDS IN ALKANES AND OTHER ORGANIC MOLECULES USING ORGANOTRANSITION METAL COMPLEXES
R. G. Bergman Oct. 1991 10 p Presented at the American Chemical Society National Meeting, San Francisco, CA, 5-10 Apr. 1992
(Contract DE-AC03-76SF-00098)
(DE92-004096; LBL-31443; CONF-920444-8) Avail: NTIS HC/MF A02

We have recently investigated the interaction of C-H activating iridium and rhodium complexes with functionalized organic molecules, to determine the effect of functional groups on the process, as well as to investigate the propensity of Ir and Rh to insert into C-H versus other types of X-H bonds. Recent experiments have shown that xenon liquefied at -70 C and 10 atm serves as an inert solvent for the C-H oxidative addition reaction. We were able to prepare and isolate, for the first time, C-H oxidative addition products formed from high-melting solid substrates such as naphthalene, adamantane, and even cubane; the latter case represents the first observation of C-H oxidative addition at a tertiary C-H bond. Liquid xenon has also allowed us to carry out the C-H oxidative addition reactions of low-boiling gases that are difficult to liquefy, such as methane. Recently we have also been able to carry out analogous studies in the gas phase. Under these conditions, 'naked' rather than solvated Cp*Rh(CO) is formed, and this species reacts with cyclohexane at nearly gas-kinetic rates. Under the conditions, collision between Cp*Rh(CO) and cyclohexane is the slowest step in the overall C-H activation process. In contrast, in solution association of solvent with free Cp*Rh(CO) is so rapid that the step involving C-H bond cleavage in the coordinated alkane complex becomes rate-determining. DOE

N92-20911# Rolls-Royce Ltd., Derby (England).
HIGH TEMPERATURE PROCESSING AND DEFORMATION OF A NEAR-ALPHA TITANIUM ALLOY
S. G. McKenzie and N. A. Walker 1 Dec. 1990 38 p Presented at Aeronat 1990
(PNR-90853; ETN-92-90801) Copyright Avail: NTIS HC/MF A03

The need for lighter weight and more efficient gas turbine engines has resulted in the development of several advanced near alpha titanium alloys with successive improvements in temperature capability. The latest in this line is IMI 834 which offers improved tensile and creep strength compared with other established creep resistance alloys such as IMI 685 and IMI 829. The hot deformation characteristics of IMI 834 are looked at. The effects of deformation on microstructure are reported along with the influence of subsequent heat treatment to produce the optimum balance of mechanical properties throughout the disc forging. The effect on mechanical properties is discussed and correlated to the microstructure using transmission electron microscopy. ESA

N92-20913# Rolls-Royce Ltd., Derby (England).
HOT DEFORMATION AND PRECIPITATION IN A NEAR ALPHA TITANIUM ALLOY
S. G. McKenzie 1 Dec. 1990 33 p Presented at the Institute of Metals Conference, Cambridge, England, 1990
(PNR-90856; ETN-92-90802) Copyright Avail: NTIS HC/MF A03

The hot deformation characteristics of a near alpha titanium alloy were developed from a comprehensive mechanical database. The effect of local strain, strain rate and temperature are discussed in relation to alpha and beta dynamic recovery and recrystallization. The evolution of substructure during deformation is also followed by scanning electron microscopy. Detailed Transmission Electron Microscopy (TEM) examination of specimens aged at 923K and 937K for between 4 and 500 hours is presented. Extensive ordering of Ti3Al was observed in the alpha phase of the heavily aged material with ordered domains as large as 400 A in some cases. The decomposition of the beta phase and the precipitation of fine silicides were followed as the ageing treatment became more severe. Chemical variations in the silicides and the alpha phase were also monitored during high temperature exposure. ESA

N92-20931# Rolls-Royce Ltd., Derby (England). Materials and Mechanical Research.
THERMO-MECHANICAL FATIGUE OF A COATED AND UNCOATED NICKEL-BASED ALLOY
J. Bressers (Joint Research Centre of the European Communities, Petten, Netherlands), J. Menigault, and T. Rhys-Jones 1 Oct. 1990 7 p
(PNR-90797; ETN-92-90771) Copyright Avail: NTIS HC/MF A02

Out of phase Thermomechanical Fatigue (TMF) tests were performed on a coated and bare nickel based alloy. Initial findings indicate that the nickel aluminide coating reduces the TMF life of the high temperature alloy for applied mechanical strain ranges less than 0.80 percent; for strain ranges in excess of this maximum value the coating has little to no effect on the fatigue resistance of the material. This result is a consequence of the differing modes of deformation which are active above and below this critical value. Specifically, for mechanical strain ranges greater than or equal to 0.80 percent the mode of deformation, is heterogeneous; whereby the TMF life is controlled by slip along glide planes and the cutting of the gamma phase. For applied strain ranges less than 0.80 percent the alloy deforms homogeneously. Dislocations are not limited to glide planes, no cutting of gamma is evident and fracture typically occurs in a direction perpendicular to the stress axis. In addition, Manson-Coffin stress data reveals the existence of a fatigue limit at approximately 550 MPa. ESA

N92-20992# Argonne National Lab., IL.
HYDROGEN EMBRITTLEMENT CONSIDERATIONS IN NIOBIUM-BASE ALLOYS FOR APPLICATION IN THE ITER DIVERTOR
D. T. Peterson (Ames Lab., IA.), A. B. Hull, and B. A. Loomis 1991 12 p Presented at the International Conference on Fusion Reactor Materials, Clearwater, FL, 17-22 Nov. 1991
(Contract W-31-109-eng-38)
(DE92-007368; ANL/CP-73174; CONF-911111-35) Avail: NTIS HC/MF A03

The ITER divertor will be subjected to hydrogen from aqueous corrosion by the coolant and by transfer from the plasma. Global hydrogen concentrations are one factor in assessing hydrogen embrittlement, but local concentrations affected by source fluxes and thermotransport in thermal gradients are more important considerations. Global hydrogen concentrations of some corrosion tested alloys will be presented and interpreted. The degradation of mechanical properties of Nb-base alloys due to hydrogen is a complex function of temperature, hydrogen concentration, stresses, and alloy composition. The known tendencies for embrittlement and hydride formation in Nb alloys are reviewed. DOE

N92-21015# Pratt and Whitney Aircraft, West Palm Beach, FL.
FATIGUE IN SINGLE CRYSTAL NICKEL SUPERALLOYS Technical Progress Report, 16 Sep. - 15 Dec. 1991
20 Dec. 1991 13 p
(Contract N00014-91-C-0124)
(AD-A244815; P/W-FR21998-2) Avail: NTIS HC/MF A03 CSCL 11/6

This program investigates the behavior of single crystal airfoil materials. The fatigue initiation processes in single crystal (SC) materials are significantly more complicated and involved than fatigue initiation and subsequent behavior of a (single) macrocrack in conventional, isotropic materials. To understand these differences, it is helpful to review the evolution of high temperature airfoils. Modern gas turbine flight propulsion systems employ single crystal materials for turbine airfoil applications because of their superior performance in resisting creep, oxidation, and thermal mechanical fatigue (TMF). These properties have been achieved by composition and alloying, and by appropriate crystal orientation and associated anisotropy. GRA

N92-21029# Lawrence Livermore National Lab., CA.
DEFORMATION AND FRACTURE BEHAVIOR OF TUNGSTEN, FIVE PERCENT RHENIUM AND UNALLOYED TUNGSTEN UNDER DYNAMIC TENSILE LOADING
D. H. Lassila and M. M. LeBlanc 10 Oct. 1991 9 p Presented at the Fall Meeting of the Minerals, Metals and Materials Society of AIME and Materials, Cincinnati, OH, 20-24 Oct. 1991
(Contract W-7405-eng-48)
(DE92-007306; UCRL-JC-108915; CONF-911003-22) Avail: NTIS HC/MF A02

The deformation behavior and ductile-brittle transition temperatures (DBTT) of unalloyed tungsten and a tungsten-5 percent rhenium alloy were investigated under quasi-static and dynamic loading conditions. Both test materials were tested in the warm-worked/wrought microstructural state. Testing was performed over a range of temperatures from 23 to 450 C. The DBTT was defined as the test temperature at which ductile (necking) failure of the test sample is expected. Consistent with other studies reported in the literature, the tungsten-5 percent rhenium alloy has a considerably lower DBTT than the unalloyed material under quasi-static loading. In contrast, under dynamic loading the tungsten-5 percent rhenium alloy and the unalloyed material exhibit similar ductile-brittle transition behavior. DOE

N92-21055# Sandia National Labs., Albuquerque, NM.
DYNAMIC MATERIAL PROPERTIES OF REFRACTORY MATERIALS: MOLYBDENUM
M. D. Furnish and L. C. Chhabildas 1991 12 p Presented at the Fall Meeting of the Minerals, Metals and Materials Society of AIME and Materials Week of the American Society of Metals, Cincinnati, OH, 20-24 Oct. 1991
(Contract DE-AC04-76DP-00789)
(DE92-003577; SAND-91-0679C; CONF-911003-21) Avail: NTIS HC/MF A03

Recently, techniques have been developed to determine dynamic material properties of refractory metals at strain rates of 10(exp 5) to 10(exp 10) sec(exp -1) and to stresses approaching 250 GPa. Similar techniques have been used to measure the dynamic properties of molybdenum; results are summarized in this paper. These experiments have allowed the determination of pressure and loading rate effects on the dynamic yield strength of molybdenum and its viscoelastic properties, as well as a determination of the Hugoniot, at relatively low stresses. Several combinations of loading and reloading and loading and unloading cycles have been employed, utilizing a compressed gas gun and VISAR diagnostics. Pressure ranges from 6.5 to 15 GPa were investigated with specimen thicknesses ranging from 1.5 to 13 mm. The Hugoniot is consistent with earlier observations at higher pressures. The Hugoniot elastic limit appears to decrease slightly with distance over the stress range reported in this study, although the decrease is of the same order as the uncertainties. Otherwise, waves are observed to be steady. Strengths at the Hugoniot Elastic Limit (HEL) and the Hugoniot state, approximately 1.5 GPa, are within the range observed for lower strain rates of 10(exp -3) sec(exp -1) to 5 x 10(exp 3) sec(exp -1), consistent with a thermal activation slip model applicable across a wide range of strain rates. Strain rate behaves as approximately as the fourth power of stress, although it appears to decrease with propagation distance over the specimen thickness range used. DOE

27 NONMETALLIC MATERIALS

Includes physical, chemical, and mechanical properties of plastics, elastomers, lubricants, polymers, textiles, adhesives, and ceramic materials.

For composite materials see *24 Composite Materials*.

N92-20080# Washington State Univ., Pullman. Dept. of Chemistry.
FREQUENCY DEPENDENCE OF TWO-PHOTON RESONANCES AND DAMPING IN POLYMERS
X. Sun, K. Nasu, C. Wu, L. Li, and D. L. Lin Dec. 1991 13 p
(Contract N00014-90-J-1193)
(AD-A243150; WSU/DC/91/TR-69) Avail: NTIS HC/MF A03 CSCL 07/6

For the two photon resonance in the third-harmonic generation (THG) spectrum of trans-polyacetylene, the existing theories can only qualitatively rather than quantitatively explain the experimental data. In this paper a damping mechanism is proposed. It shows that once the excitation-dependent damping is taken into account, the whole experimental spectrum of the THG can be quantitatively interpreted by our theoretical calculations. GRA

N92-20087# Texas Univ., Austin. Dept. of Chemistry and Biochemistry.
POLYMERS AT LIQUID-LIQUID INTERFACES: PHOTOPHYSICS AND PHOTOREDOX CHEMISTRY
S. E. Webber Dec. 1991 4 p
(Contract DE-FG05-86ER-13629)
(DE92-005465; DOE/ER-13629/5) Avail: NTIS HC/MF A01

This report consists of three sections: study of triplet state electron transfer from polymer-bound anthracene and pyrene chromophores, adsorption of alternating block and comb polymers onto polymer surfaces, and discussion of transient absorption systems. Additionally, a bibliography of recent publications is presented. DOE

N92-20089# Arizona State Univ., Tempe.
HIGH RESOLUTION ENERGY LOSS RESEARCH: Si COMPOUND CERAMICS AND COMPOSITES
R. W. Carpenter and S. H. Lin 1990 59 p
(Contract DE-FG02-87ER-45305)
(DE92-007119; DOE/ER-45305/3) Avail: NTIS HC/MF A04

This report discusses proposed work on silicon compound ceramics and composites. High resolution composition and structure analysis of interfaces in ceramic and metal matrix composites and certain grain boundaries in silicon and its interfaces with oxides and nitrides is proposed. Composition and bonding analysis will be done with high spatial resolution (20 Angstroms or better) parallel electron energy loss spectroscopy using a field emission analytical electron microscope. Structural analysis will be done at the 1.8 Angstrom resolution level at 200kV by HREM. Theoretical electron energy loss cross section computations will be used to interpret electronic structure of these materials. Both self-consistent field MO and multiple scattering computational methods are being done and evaluated. DOE

N92-20098# Oak Ridge National Lab., TN.
REPORT ON THE PLANNING WORKSHOP ON COST-EFFECTIVE CERAMIC MACHINING
P. J. Blau Nov. 1991 75 p Presented at the Cost Effective Ceramic Machining Workshop, Oak Ridge, TN, 22-23 May 1991
(Contract DE-AC05-84OR-21400)
(DE92-005333; ORNL/M-1745; CONF-9105297-Summ) Avail: NTIS HC/MF A04

A workshop on 'Cost Effective Ceramic Machining' (CECM) was held at Oak Ridge Associated Universities Pollard Auditorium, Oak Ridge, Tennessee, May 1991. The purpose of this workshop was to present a preliminary project plan for industry critique and to identify specific components and cost reduction targets for a new project on Cost Effective Ceramic Machining. The CECM project is an extension of the work on the Ceramic Technology for Advanced Heat Engines (CTAHE) Program sponsored by the Department of Energy, Office of Transportation Materials. The workshop consisted of fifteen invited papers, discussions, a survey of the attendee's opinions, and a tour of the High Temperature Materials Laboratory at ORNL. The total number of registrants was sixty-seven, including thirty-three from industry or private sector organizations, seven from universities, three from industry groups, fourteen from DOE laboratories (including ORNL, Y-12, and Lawrence Livermore Laboratory), three from trade associations, and three from other government organizations. Forty-one survey forms, which critiqued the proposed project plan, were completed by attendees, and the results are presented in this report. Valves, cam roller followers, water pump seals, and diesel engine head plates were rated highest for application of ceramic machining concepts to reduce cost. Coarse grinding, abrasives and wheel technology, and fine grinding were most highly rated as regards their impact on cost reduction. Specific cost reduction targets for given parts varied greatly in the survey results and were not felt to be useful for the purposes for the CECM plan development. A range of individual comments were obtained and are listed in an appendix. As a result of the workshop and subsequent discussions, a modified project plan, different in certain aspects from the original CECM plan, has been developed. DOE

N92-20101# Argonne National Lab., IL.
SYNTHESIS OF RARE-EARTH-BASED OXIDES FOR THE CERAMIC INDUSTRY: FROM LABORATORY TO PILOT PLANT
U. Balachandran, S. E. Dorris, M. T. Lanagan, R. B. Poeppel, J. M. Tourre, and J. W. Golowski Nov. 1991 14 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract W-31-109-eng-38)
(DE92-006981; ANL/CP-73621; CONF-911202-46) Avail: NTIS HC/MF A03

A wide variety of compounds, e.g., superconductors, chromites, and manganites, have been synthesized by spray drying a mixture of salts or a combination of salts and sols in a flash dryer. The process allows for good control of stoichiometry, morphology, particle size, and surface area. Appropriate particle-growth and synthesis heat treatments of these fine powders were performed. The resultant powders were evaluated for possible applications in fuel cells and superconductors. The processes have been scaled up to a capacity of approx. 40 Kg a day. DOE

N92-20113# Sandia National Labs., Albuquerque, NM.
SYNTHESIS OF A (60)C-PARA-XYLYLENE COPOLYMER
D. A. Loy and R. A. Assink 1991 6 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC04-76DP-00789)
(DE92-005456; SAND-91-2455C; CONF-911202-31) Avail: NTIS HC/MF A02

The preparation and purification of macroscopic quantities of buckminsterfullerenes of buckyballs has ignited an explosion of research into their physical and chemical properties, and a variety of strategies for preparing new fullerene-based materials. Free radical synthesis is an appealing approach for forming polymeric fullerene materials. We report a polymeric fullerene material prepared by reacting pure C-60 with xylylene from the thermolysis of paracyclophane. Addition of xylylene to purple solution of C-60 in toluene solution at -78 C resulted in an olive-green solution from which an insoluble brown powder precipitated upon warming to room temperature. Analyses of the powder by solid state C-13 MAS NMR, IR, and thermal gravimetric analysis are consistent with a (60)C-xylylene copolymer. DOE

N92-20118# Arizona State Univ., Tempe.
HIGH RESOLUTION ENERGY LOSS RESEARCH: Si COMPOUNDS AND CERAMICS
R. W. Carpenter and S. H. Lin 1992 4 p
(Contract DE-FG02-87ER-45305)
(DE92-006416; DOE/ER-45305/5) Avail: NTIS HC/MF A01

Our current investigation of the structure and chemistry of whisker/matrix interfaces and matrix grain boundaries in SiC whisker reinforced Si3N4 composites has been completed. We examined these interfaces and boundaries in four composites whose starting materials and processing were identical except for the SiC whiskers themselves, which were from four different sources: American matrix, Nikkei, Huber and Tokai. Thus, differences in interfaces among the composites are attributable to differences in the whiskers. The results showed that oxygen-rich amorphous interfacial layers were discontinuous in all whisker/matrix interfaces and continuous in all matrix grain boundaries. Further, we used position-resolved high spatial resolution electron energy loss spectroscopy to show that the 'chemical interface width' is much wider than the 'geometric or structural interface width' at both types of interfaces in all four composites. The geometric interface widths were determined from high resolution transmission electron microscope images of edge-on interfaces. DOE

N92-20122# Ames Lab., IA.
SYNTHESIS AND CHARACTERIZATION OF NANOCRYSTALLINE SILICIDE COMPOUNDS Ph.D. Thesis
B. Karen 3 Jan. 1992 59 p
(Contract W-7405-eng-82)
(DE92-005364; IS-T-1588) Avail: NTIS HC/MF A04

This thesis investigates the production of nanocrystalline silicide compounds using radio frequency inductively coupled plasma (RF-ICP) and mechanical milling. A system was constructed that utilized a RF-ICP, a powder feed system, and a condensation/collection chamber to produce nanocrystalline materials. Several silicides, such as Ti5Si3, Cr3Si, and MoSi2, were fed into the plasma and vaporized. The vaporized material then passed into a connecting chamber, where it condensed out of the vapor phase and the resulting powder was collected. Much of the work conducted was in designing and building the systems components. This was followed by establishing the plasmas operating parameters. The material collected from the ICP chamber was then compared to material produced by mechanical milling. The material produced by both methods were characterized by x-ray diffraction, scanning and transmission-electron microscopy, and energy dispersive spectroscopy. The results indicate that it is possible to produce nanocrystalline material by mechanical milling; however, there is a significant amount of contamination from the milling ball and milling container. The results also show that the Ti5Si3 and Cr3Si compounds can be produced in nanocrystalline

form by the ICP method. The resultant material collected from the ICP chamber following the MoSi2 run consisted of nanocrystalline Si and crystalline, Mo rich Si compound. Inductively coupled plasma-atomic emission spectroscopy (ICP-AES) was also used to observe the powders as they passed through the plasma. The resulting data indicate that each compound was vaporized and dissociated in the plasma. The following thesis describes the apparatus and experimental procedure used in producing nanocrystals. DOE

N92-20137# Oak Ridge Y-12 Plant, TN.
COST EFFECTIVE CERAMIC MANUFACTURING AT THE MARTIN MARIETTA ENERGY SYSTEMS, INC. MANUFACTURING TECHNOLOGY DEPLOYMENT CENTER
W. E. Barkman, T. O. Morris, and P. J. Blau 1992 12 p
(Contract DE-AC05-84OS-21400)
(DE92-006669; Y/DX-2083) Avail: NTIS HC/MF A03

A Ceramic Technology Project was initiated at the Oak Ridge National Laboratory (ORNL) in 1983 to develop an industry technology base for reliable, high temperature ceramics for use in advanced engines such as the ceramic gas turbine and low heat rejection, heavy-duty truck engines. The plan for this project was developed jointly by industry, academia, and the U.S. Government. The plan was developed following a needs assessment which determined the critical technology base requirements, the potential economic value of structural ceramics, the extent of ongoing and planning research and development programs, and the estimated funding that would be required. The High Temperature Materials Laboratory (HTML) at ORNL serves as a focal point for the Ceramic Technology Project. HTML activities are designed to address the high-temperature materials problems that limit the efficiency and reliability of advanced energy conversion systems and to assist U.S. industry in meeting the challenge of foreign competition. The HTML also functions as a user facility for industrial and university researchers. It contains the special research equipment that is needed to characterize a material's microstructure and microchemistry as well as physical and mechanical properties. This report discusses the cost effectiveness of ceramic manufacturing at the MTDC. DOE

N92-20139# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Obninsk (USSR). Fiziko-Ehnergeticheskij Inst.
AMPLITUDE-DEPENDENT ULTRASOUND ABSORPTION AND EFFECTIVE ELASTIC MODULUS OF Y-Ba-Cu-O CERAMICS WITHIN THE RANGE OF 6 TO 290 K
S. B. Kustov, B. K. Kardashev, and V. I. Ivanov (Academy of Sciences, USSR, Leningrad) 1990 20 p In RUSSIAN; ENGLISH summary
(DE92-606585; FEI-2141) Avail: NTIS HC/MF A03

The results of experimental investigation of amplitude-dependent attenuation of ultrasonic longitudinal standing waves at a fraquency of about 100 kHz in ceramics YBa2Cu3O sub y with y = 6.92 and y = 6.27 are presented and analyzed within the framework of ideas of corriers of plastic deformation (dislocations). Under the same ambient conditions the microplastic deformation rate (proportional to the product of dislocations mobility into their density) is shown to be considerably higher in the orthorhombic phase whithin the temperature range of 6-290 K, as compared to the tetragonal one. The acoustic investigation data are compared with the specific features of changes in thermal properties. DOE

N92-20144# Pacific Northwest Lab., Richland, WA.
OXYGEN PERMEABILITY OF SEVERAL CERAMIC OXIDES ABOVE 1200 C
E. L. Courtright and J. T. Prater Jan. 1992 33 p Presented at the 16th Annual Conference on Composites, Materials, and Structures, Coca Beach, FL, 13-16 Jan. 1992
(Contract DE-AC06-76RL-01830)
(DE92-006733; PNL-SA-20302; CONF-920144-3) Avail: NTIS HC/MF A03

Oxygen permeability as a function of temperature was measured for several ceramic oxides over the range 1200 to 1700 C. Of the oxides testbed, alumina, beryllia, yttria, lanthanum halfnate, and calcium zironcate exhibited the lowest permeabilities in order of decreasing resistance to oxygen transport. None of the permeability constants were less than the 10(exp -10) to 10(exp -12) g O2/cm (center dot) s needed for a useful protective coating system above 1500 C. In some of the mixed oxide compounds, cation segregation was observed to occur with the more rapidly diffusing species segregating to the side of highest oxygen potential. Thus, segregation must be considered when selecting mixed oxides for high temperature applications. DOE

N92-20298# Brookhaven National Lab., Upton, NY.
CHANGES IN ELECTRICAL PROPERTIES OF HIGH RESISTIVITY SILICON CAUSED BY FAST NEUTRON DAMAGE
Zheng Li and H. W. Kraner Sep. 1991 14 p Presented at the 3rd Workshop on Radiation-Induced and/or Process-Related Electrically Active Defects in Semiconductor-Insulator Systems, Research Triangle Park, NC, 10-13 Sep. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005035; BNL-46198; CONF-9109329-1) Avail: NTIS HC/MF A03

P(+)-n(--)n(+) silicon radiation detectors made of high resistivity Si material (rho greater than or = 2 k(Omega)-cm) were irradiated to a neutron fluence of a few times of 10(exp 13) n/sq cm. Dependence of detector leakage current, reverse bias capacitance, and effective doping concentration of the Si substrate on the neutron fluence have been systematically studied. Models using several defect levels in band gap describing the frequency dependent C-V effect and electrical field profile at high neutron fluence (phi sub n greater than 10(exp 13) n/sq cm) are proposed in this study. DOE

N92-20306# National Inst. of Standards and Technology, Gaithersburg, MD. Ceramics Div.
INSTITUTE FOR MATERIALS SCIENCE AND ENGINEERING, CERAMICS: TECHNICAL ACTIVITIES, 1991
S. W. Freiman Feb. 1992 176 p
(PB92-126507; NISTIR-4694) Avail: NTIS HC/MF A09 CSCL 07B

In 1991, the Ceramics Div. continued its program of standards development, data generation and evaluation, and research focused on the characterization and understanding of material behavior. The research program focused on the critical issues which control the implementation of advanced ceramics and is developed through internal assessment and consultation with representatives from ceramic industries and academia. Some areas of research were: ferroelectric oxide films, glass compositions, advanced ceramics, power processing, modelling, and superconductivity. Author

N92-20380*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
RELIABILITY ANALYSIS OF LAMINATED CMC COMPONENTS THROUGH SHELL SUBELEMENT TECHNIQUES
Alois Starlinger, Stephen F. Duffy (Cleveland State Univ., OH.), and John P. Gyekenyesi 1992 12 p Proposed for presentation at the 33rd Structures, Structural Dynamics and Materials Conference, Dallas, TX, 13-15 Apr. 1992; sponsored by AIAA
(NASA-TM-105413; E-6819; NAS 1.15:105413; AIAA-92-2348)
Avail: NTIS HC/MF A03 CSCL 11B

An updated version of the integrated design program Composite Ceramics Analysis and Reliability Evaluation of Structures (C/CARES) was developed for the reliability evaluation of ceramic matrix composites (CMC) laminated shell components. The algorithm is now split into two modules: a finite-element data interface program and a reliability evaluation algorithm. More flexibility is achieved, allowing for easy implementation with various finite-element programs. The interface program creates a neutral data base which is then read by the reliability module. This neutral data base concept allows easy data transfer between different computer systems. The new interface program from the finite-element code Matrix Automated Reduction and Coupling (MARC) also includes the option of using hybrid laminates (a

combination of plies of different materials or different layups) and allows for variations in temperature fields throughout the component. In the current version of C/CARES, a subelement technique was implemented, enabling stress gradients within an element to be taken into account. The noninteractive reliability function is now evaluated at each Gaussian integration point instead of using averaging techniques. As a result of the increased number of stress evaluation points, considerable improvements in the accuracy of reliability analyses were realized. Author

N92-20386# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de la Physique Generale.
MEASUREMENT OF THE FINISHING PAINT THICKNESS ON AIR VEHICLES: PROTOTYPE PRESENTATIONS [MESURE DE L'EPAISSEUR DE PEINTURE DE FINITION SUR AERONEFS. PRESENTATION DU PROTOTYPE]
A. Bruere and J. C. Godefroy Feb. 1991 18 p In FRENCH
(Contract STPA-87-95-004)
(ONERA-RT-3/3801-PY; ETN-92-90874) Avail: NTIS HC/MF A03

A paint thickness evaluation device is described. The prototype of the device uses capacitance transducers allowing it to improve on conventional systems which are only able to measure the thickness of insulating layers deposited on the metallic substrate. Such conventional systems will not work on substrates such as carbon composites or isolating composites treated with antistatic protection layers. Conventional systems depend on Foucault currents which can only be applied to metallic surfaces. ESA

N92-20415# Defence Research Establishment Atlantic, Dartmouth (Nova Scotia).
A REVIEW OF THE THEORY OF THE PIEZOELECTRIC EFFECT IN CERAMICS
Dennis F. Jones Dec. 1990 67 p
(DREA-90-101; CTN-92-60441) Avail: NTIS HC/MF A04

A review of the linear piezoelectric and the rotationally invariant nonlinear electrostatic theories is presented, and related to ceramic behavior. The linear piezoelectric equations and the linear electrostatic equations for small dynamic fields superposed on a static bias are obtained from the general electrostatic equations. A perturbation technique for predicting changes in the resonance frequency of vibrating piezoelectric solids is discussed for electrical and mechanical biases as well as for other physical phenomena. The linear electrostatic equations for small fields superposed on a bias are determined and applied to the poling of ceramics. The effects of biasing stresses, biasing fields, and other perturbing phenomena, on the eigen frequencies of piezoelectric solids are discussed in terms of perturbation theory. The linear piezoelectric equations are reformulated into matrix notation. CISTI

N92-20547# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
MATERIALS FOR FRICTION DRAG REDUCTION THIN FILMS
Francisco Leme Galvao Jul. 1991 7 p Presented at the 12th Congresso Brasileiro de Aplicacoes de Vacuo na Industria e na Ciencia, Florianoplis, Brazil, 23-25 Jul. 1991
(INPE-5275-PRE/1689) Avail: NTIS HC/MF A02

It is argued that friction drag reductions in aerospace vehicles could result from the use of external surface thin film coverings with atomic level smoothness. The dynamics of the gas-solid surface interactions, the absorption phenomena, and the effects of the surface atomic structure on absorption forces are discussed in order to identify the most adequate materials for such an application. It is concluded that some heavy transition metal halides and dichalcogenides with Van der Waals layered crystalline structures represent an adequate starting point for further research. Author

N92-20644*# Analex Corp., Brook Park, OH.
FLEXURAL STRESS RUPTURE AND CREEP OF COMMERCIAL SILICON NITRIDES Final Report
William A. Sanders and Lance E. Groseclose (General Motors Corp., Indianapolis, IN.) Dec. 1991 22 p
(Contracts NAS3-25776; DE-AI01-90CE-50300)
(NASA-CR-189074; E-6685; NAS 1.26:189074;
DOE/NASA/5776-1) Avail: NTIS HC/MF A03 CSCL 11C

Four commercial Si3N4 compositions were compared with regard to flexural stress rupture and creep in ambient air as a function of temperature from 1100 to 1400 C and stress from 200 to 350 MPa. One Si3N4, SN252, was found to be more resistant to time-dependent deformation in both stepped-temperature stress rupture tests and creep tests than a very similar Si3N4 composition and two other dissimilar Si3N4 compositions. Materials were compared on the basis of percent final strains, creep rates, and post-test microscope examinations. The latter revealed tensile face transverse cracking, and slow crack growth. The superior behavior of the SN252 Si3N4 was related to its microstructure. Author

N92-20657# National Inst. of Standards and Technology, Gaithersburg, MD.
FLAMMABILITY CHARACTERIZATION OF FOAM PLASTICS
T. G. Cleary and J. G. Quintiere Oct. 1991 143 p Sponsored by Society of the Plastics Industry, Washington, DC
(PB92-123033; NISTIR-4664) Avail: NTIS HC/MF A07 CSCL 11C

The results of a study to identify an alternative test protocol to the Steiner Tunnel test as a measure of flammability for foamed plastics are presented. New fire test apparatuses, namely, the Cone Calorimeter and the Lateral Ignition and Flame Spread apparatus were used to more completely characterize foamed plastic flammability. Key flammability properties obtained from these apparatuses describe ignitability, flame spread rate, rate of heat release, and smoke obscuration. An extensive data set of these flammability properties for 10 selected foamed plastics was generated. The tested materials included melting foams (polystyrene foams) and charring foams (polyurethanes, polyisocyanurate, and phenolic foams). The effects of melting and dripping were limited by testing the materials in the horizontal orientation. In addition, an integrated approach to material flammability characterization is presented that uses these parameters to predict fire growth potential. GRA

N92-20660*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PROPERTIES DATA FOR OPENING THE GALILEO'S PARTIALLY UNFURLED MAIN ANTENNA
Kazuhisa Miyoshi and Stephen V. Pepper Feb. 1992 25 p
(NASA-TM-105355; E-6729; NAS 1.15:105355) Avail: NTIS HC/MF A03 CSCL 11C

An investigation was conducted into the friction and wear behavior of both unlubricated and dry-film-lubricated (Tiolube 460) titanium alloy (Ti-6Al-4V) in contact with an uncoated high-nickel-content superalloy (Inconel 718) both in vacuum and in air. The acquisition of friction and wear data for this sliding couple was motivated by the need for input data for the 'antenna stuck ribs model' effort to free Galileo's High Gain Antenna. The results of the investigation indicate that galling occurred in the unlubricated system in vacuum and that the coefficient of friction increased to 1.2. The abnormally high friction (1.45) was observed when relatively large wear debris clogged at the sliding interface. The coefficient of friction for the dry-film-lubricated system in vacuum is 0.04, while the value in air is 0.13. The endurance life of the dry-film lubricant is about three orders of magnitude greater in vacuum than in air. The worn surfaces of the dry-film-lubricated Ti-6Al-4V pin and Inconel 718 disk first run in humid air and then rerun in vacuum was completely different from that of the pin and disk run only in vacuum. When galling occurred in the humid-air and vacuum contact, coefficient of friction rose to 0.32 when sliding in humid air and to 1.4 when sliding in vacuum. The galling was accompanied by severe surface damage and extensive transfer of the Ti-6Al-4V to the Inconel 718, or vice versa. When spalling occurred in the dry-film-lubricated Ti-6Al-4V pin run only in vacuum, the coefficient of friction rose to 0.36 or greater. The wear damage caused by spalling can self-heal when rerun in vacuum - the coefficient of friction decreased to 0.05. The friction and wear

data obtained can be used for the 'antenna stuck ribs model' effort to free Galileo's high gain antenna. Author

N92-20791# Case Western Reserve Univ., Cleveland, OH. Dept. of Macromolecular Science.
MOLECULAR ENGINEERING OF LIQUID CRYSTAL POLYMERS BY LINING POLYMERIZATION. PART 16: TAILOR-MADE s(SUB C)* MESOPHASE IN COPOLYMERS OF 4-((S-(-)-2-METHYL 1-BUTYL)OXYCARBONYL) 4'-(OMEGA-OXYALKYL-1-VINYL ETHER BIPHENYL WITH UNDECANYL OCTYL ALKYL GROUPS
Virgil Percec, Qiang Zheng, and Myongsoo Lee 30 Oct. 1991 29 p
(Contract N00014-89-J-1828)
(AD-A242350; TR-52-Pt-16) Avail: NTIS HC/MF A03 CSCL 07/6

The synthesis and living cationic polymerization of4-((S(-) 2-methyl-1-butyl)oxycarbonyl)-4' (8-ox yoctyl-1 vinyl ether)biphenyl are described. Polymers with degree of polymerization lower than 40 and polydispersities were synthesized and characterized by differential scanning calorimetry (DSC) and thermal optical polarized microscope. All polymers exhibit enantiotropic s sub A and s sub C* mesophases. Polymers with degrees of polymerization higher than 17 exhibit also an enantiotropic unidentified s sub X mesophase. Copolymers of 14-8 with 4-((S-(-)-2-methyl 1-butyl)oxycarbonyl) 4'-(11-oxyundecanyl 1-vinyl ether)biphenyl were synthesized to cover the entire range of composition at a degree of polymerization of 15. The phase behavior of these copolymers was investigated and demonstrated a behavior similar to an ideal solution derived from the structural units. This copolymerization experiment allowed the synthesis of copolymers exhibiting, depending on the composition, a s sub C* mesophase from below 10 C to up to 50 to 80 C. GRA

N92-20833# Department of the Navy, Washington, DC.
LASER-DEPOSITED BIOCOMPATIBLE FILMS, AND METHODS AND APPARATUSES FOR PRODUCING SAME Patent Application
Catherine M. Cotell, inventor (to Navy), Douglas B. Chrisey, inventor (to Navy), Kenneth S. Grabowski, inventor (to Navy), and James A. Sprague, inventor (to Navy) 31 Jul. 1991 23 p
(AD-D015181; US-Patent-Appl-SN-738362) Avail: NTIS HC/MF A03 CSCL 11/3

The present invention provides a method and an apparatus for laser depositing a thin film of biocompatible material of controlled chemical composition and crystalline structure onto a substrate to provide articles which may be used as medical or orthopedic implants, and to articles formed thereby. An object of the present invention is to provide techniques for depositing biocompatible material onto a substrate, which make it possible to (1) control whether the deposited film is amorphous or crystalline (or a mixture of amorphous and crystalline), (2) control the morphology (porosity and substrate/film interface structure) of the deposited film, (3) (in the case of crystalline phases) control the ratio of hydroxylapatite to phosphate compounds (i.e., alpha-tricalcium phosphate, Beta-tricalcium phosphate and tetracalcium phosphate), (4) control the calcium/phosphorus ratio of the deposited film, and (5) control the resorbability of the deposited film. Another object of the present invention is to provide such a technique which provides greater flexibility in the selection of process parameters, e.g., temperature at deposition. A further object of the present invention is to provide such a technique in which good adhesion between the substrate and the deposited film is achieved. There is provided a method for depositing bioceramic material onto a substrate. GRA

N92-20860# Sandia National Labs., Albuquerque, NM.
FRACTAL ASPECTS OF THE STRUCTURE AND DYNAMICS OF SILICA GELS
J. E. Martin 1991 3 p Presented at the American Chemical Society National Meeting, San Francisco, CA, 5-10 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-004731; SAND-91-2556C; CONF-920444-5) Avail: NTIS HC/MF A01

Silica gels are technologically important materials with a rich chemistry, yet relatively little is known about the evolution of structure of these complex materials. In part, the complexity of silica gels arises from the wealth of synthetic routes used to produce them. A typical synthetic process depends on such parameters as the pH, concentration of monomer, water, catalyst, salt etc., and these parameters are usually varied in an empirical fashion to produce a suitable gel time, gel density, and so forth. That the evolution of structure in these gels is so poorly understood is partially due to the fact that researchers are unable to agree on exactly what is meant by structure. Once a suitable definition of structure is adopted, one could then investigate some basic questions. Since the most dramatic physical changes occur in the vicinity of the sol-gel transition, this regime would seem to offer the most fruitful initial avenue of investigation. The investigations we have made on the sol-gel transitions include relatively straightforward static structure measurements as well as more complex determinations of dynamical properties. To interpret these measurements we have used the well known analogy between the sol-gel transition and a second-order thermodynamic phase transition to develop theories of the elastic and inelastic light scattering behavior, and viscoelastic phenomena. In this article we give a overview of the various aspects of the sol-gel transition in silica. DOE

N92-20953# National Research Council of Canada, Ottawa (Ontario). Inst. for Research in Construction.
APPLICATION OF THREE ASTM METHODS TO MEASURE THERMAL RESISTANCE OF CLOTHING Final Report
M. T. Bomberg May 1991 26 p Sponsored by Defence Research Establishment
(DREO/PSD/EPS-01/91; CTN-92-60418) Avail: NTIS HC/MF A03

The thermal insulating performance of protective clothing worn in a cold climate may vary over an order of magnitude due to sweating and changes in blood circulation near the surface of the skin. This interaction between the human body and clothing imposes stringent requirements on the methods that can be used to evaluate thermal performance of clothing systems. The preferred method should characterize thermal performance of the fabric exclusive of all body-clothing interaction. The objective of the work described here was to examine to what extent the most precise ASTM thermal insulation test methods, in particular ASTM standards C177 employing a guarded hot plate (GHP), C518 employing a heat flow meter (HFM), and C1114 employing a thin heater (TH) apparatus, could be modified for measurement of the thermal performance of clothing fabrics and clothing insulating systems. The three methods were found acceptable for testing thermal resistance of insulating clothing systems. A standard air layer, used in series with the test specimen and placed on the cold side of the tested fabrics, reduces experimental errors and permits testing radiative properties of the fabric surface. Thermal resistance of the standard air layer varied significantly between different testing arrangements. The use of the bare plate measurements in a test where a textile fabric is exposed to air movement was found to introduce significant errors. Several changes to the tested standard methods are recommended for testing of protective clothing. CISTI

N92-20957# Oak Ridge National Lab., TN.
STRUCTURE AND DOSE EFFECTS ON ION BEAM MODIFICATION OF POLYMERS
G. R. Rao, E. H. Lee, and L. K. Mansur 1991 12 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-006860; CONF-911202-43) Avail: NTIS HC/MF A03

Polyethylene (PE), polypropylene (PP), polystyrene (PS) and polyethersulfone (PES) were implanted with 200 keV boron ions at three different doses. PS was also implanted with 100 keV boron. A nanoindentation technique and reciprocating sliding wear

tests were used to characterize mechanical properties of the implanted polymers. The results showed that hardness increased with increasing dose as well as increasing energy. The relative increase in hardness was reduced with increasing complexity of the side groups of the polymer chains although absolute hardness values were higher. With increasing complexity of the main backbone polymer chain, the relative increase in hardness as well as numerical hardness values were lower. These effects were attributed to the relative contributions of cross-linking and chain scission, which were viewed as competing processes. Wear tests showed that, in general, a low or intermediate implant dose yielded the best improvement in wear resistance. No specific trends were observed relating friction coefficient values and improved wear resistance. DOE

N92-21018# National Research Council of Canada, Ottawa (Ontario). Inst. for Aerospace Research.
PHOTOELASTIC COATING STUDY OF CT-114 COUPON JOINT TEST SPECIMEN FOR HORIZONTAL STABILIZER REAR ATTACHMENT FITTING TO VERTICAL STABILIZER REAR SPAR
J. P. Komorowski 15 Sep. 1988 19 p
(Contract DND-FE-847787FACBF; NAE Proj. 03336)
(NRC-LTR-ST-1689; CTN-91-60291) Copyright Avail: NTIS HC/MF A03

As part of a program of life extension of Canadian Forces CT-114 Tutor jet trainer aircraft, an experimental investigation was initiated on the durability and damage tolerance of the horizontal stabilizer rear attachment fitting and its attached components from the vertical stabilizer rear spar. A photoelastic coating study of a coupon test specimen is described. The method is briefly explained to aid in interpretation of results. Additional fasteners will have to be included in the coupon test specimen to prevent skin buckling and to better simulate actual structure. Load transfer in the joint is mainly through friction generated by rivet clamp up. The use of rivets with larger heads for the test specimen may influence results by providing better clamp up. Author (CISTI)

N92-21045# Argonne National Lab., IL.
ANALYSIS OF CERAMIC COMPOSITES BY 3D MICROTOMOGRAPHY
T. Luethi (Federal Labs. for Testing Materials and Research, Dubendorf, Switzerland) and W. A. Ellingson 1991 10 p Presented at the 4th International Symposium on Ceramic Materials and Components for Engines, Goeteborg (Sweden), 10-12 Jun. 1991
(Contract W-31-109-eng-38)
(DE92-003415; ANL/CP-74654; CONF-910617-6) Avail: NTIS HC/MF A02

In the first part we describe the use of three-dimensional X-ray microtomography for the analysis of density distributions inside and between cold pressed green state whisker reinforced Si3N4/Si3N4 bending test specimens. The differences between a changing content of whisker volumes (0 to 35 percent) show a sharp density reduction between 10 and 15 percent. This agrees with previous research which shows that maximum density is achieved between 10 and 15 percent whisker loadings. Since density is directly related to fracture strength, microtomography may be useful as strength prediction. In the second part we describe the use microtomography combined with image processing, especially a two-dimensional Fourier transform, for the analysis of cloth direction distributions in multidirectional reinforced chemical vapor infiltrated (CVI) SiC/SiC test components. The SiC fibers were NICALON (trademark) and were oriented 30, 60, and 90 degrees. In laying up the cloth, orientations may not be maintained and this impacts the mechanical properties. Use of microtomography with image processing may allow mechanical property variations to be established. DOE

N92-21063# Oak Ridge National Lab., TN.
FABRICATION AND TESTING OF CORROSION RESISTANT COATINGS
D. P. Stinton, J. C. McLaughlin, and L. Riester 1991 9 p Presented at the 4th International Symposium on Ceramic Materials and Components for Engines, Goeteborg (Sweden), 10-12 Jun. 1991
(Contract DE-AC05-84OR-21400)
(DE92-003553; CONF-910617-7) Avail: NTIS HC/MF A02

The susceptibility of SiC and Si3N4 to sodium corrosion mandates that corrosion resistant coatings be developed to protect silicon-based turbine engine components. Materials with good corrosion resistance and thermal expansions that nearly match SiC and Si3N4 have been identified. Corrosion testing of hot-pressed pellets of these compounds has identified the most promising materials. Development of chemical vapor deposition systems to apply these materials has been initiated. DOE

N92-21065# Lawrence Livermore National Lab., CA.
LOW DENSITY METAL HYDRIDE FOAMS Patent Application
J. L. Maienschein, inventor (to DOE) and P. E. Barry, inventor (to DOE) 31 May 1990 28 p
(Contract W-7405-eng-48)
(DE92-003729; US-Patent-Appl-SN-531363; Patents-US-A7531363) Avail: NTIS HC/MF A03

Disclosed is a low density foam having a porosity of from 0 to 98 percent and a density less than about 0.67 gm/cc. It was prepared by heating a mixture of powdered lithium hydride and beryllium hydride in an inert atmosphere at a temperature ranging from about 455 to about 490 K for a period of time sufficient to cause foaming of said mixture, and cooling the foam thus produced. Also disclosed is the process of making the foam. DOE

N92-21066# Lawrence Livermore National Lab., CA.
LOW DENSITY MICROCELLULAR FOAMS Patent Application
J. D. LeMay, inventor (to DOE) 8 May 1990 45 p
(Contract W-7405-eng-48)
(DE92-003744; US-Patent-Appl-SN-535007; Patents-US-A7535007) Avail: NTIS HC/MF A03

Disclosed is a process of producing microcellular foam which comprises the steps of: selecting a multifunctional epoxy oligomer resin; mixing said epoxy resin with a nonreactive diluent to form a resin-diluent mixture; forming a diluent containing crosslinked epoxy gel from said resin-diluent mixture; replacing said diluent with a solvent therefore; replacing said solvent with liquid carbon dioxide; and vaporizing off said liquid carbon dioxide under supercritical conditions, whereby a foam having a density in the range of 35 to 150 mg/cc and cell diameters less than about 1 micron is produced. Also disclosed are the foams produced by the process. DOE

28 PROPELLANTS AND FUELS

Includes rocket propellants, igniters, and oxidizers; their storage and handling procedures; and aircraft fuels.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *44 Energy Production and Conversion.*

N92-20132# Sandia National Labs., Albuquerque, NM.
IN SITU MEASUREMENT OF PARTICLE FORMATION IN HEATED JET FUELS: A NEW APPLICATION OF PHOTON CORRELATION SPECTROSCOPY
W. M. Trott, T. J. OHern, and E. A. Klavetter 1991 9 p Presented at the American Chemical Society National Meeting, San Francisco, CA, 5-10 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-003641; SAND-91-2444C; CONF-920444-2) Avail: NTIS HC/MF A02

A noninvasive dynamic light scattering technique, photon correlation spectroscopy, has been used to examine the formation of submicron diameter particles in thermally stressed JP-8 and Jet A-1 fuels. An understanding of the particle formation processes is needed in order to characterize jet fuel thermal degradation and to assist in the development of highly stable fuel compositions. In situ measurements in pre-stressed fuel samples have shown

that relatively large particles (200-800 nm mean hydrodynamic diameter) are formed at temperatures less than 200 C and indicate a trend toward increasing particle size with increasing stress temperature. Real-time PCS measurements during fuel heating tests have also been performed. These tests suggest that incipient particle formation occurs at temperatures as low as 110 C. At 150-170 C, scattering from large (0.3-1 micron) particles dominates the real-time PCS signal. Observed trends in particle size distribution with maximum stress temperature and exposure time will be discussed. DOE

N92-20281 Georgia Inst. of Tech., Atlanta.
THE ROLE OF THE COMBUSTION ZONE MICROSTRUCTURE IN THE PRESSURE-COUPLED RESPONSE OF COMPOSITE PROPELLANTS Ph.D. Thesis
Christopher Alan Beiter 1991 141 p
Avail: Univ. Microfilms Order No. DA9136224

The role of the combustion zone microstructure of the diffusion flame in the pressure coupled response of composite rocket propellants was studied. The leading edge portion of the diffusion flame, referred to as the leading edge flame (LEF), is thought to play an important part in the response of the surface of a pyrolyzing propellant to imposed pressure fluctuations. The T-burner was used to create a standing pressure wave in the presence of a combustion environment, thus allowing for observation of the interaction of the propellant combustion and the acoustic field. In order to quantify the behavior of the LEF in an oscillatory environment, a bimodal ammonium perchlorate hydrocarbon propellant was fired in the T-burner over a characteristic pressure range. The bimodal oxidizer size distribution consisted of nominal 400 micron coarse ammonium perchlorate (AP) and fine AP in the range of 10 to 100 microns. The T-burner results indicate a definite trend in the response function with pressure at frequencies of 500 and 800 Hz. Pronounced peaks in the pressure coupled response at pressures of 250 to 300 psia are indicative of singular LEF behavior, brought about by unstable flamelets on the fine AP particles in this pressure range. Dissert. Abstr.

N92-20344# Sandia National Labs., Albuquerque, NM.
USING MONTE CARLO TECHNIQUES AND PARALLEL PROCESSING FOR FRAGMENTATION ANALYSIS OF EXPLOSIVE PAYLOADS
R. A. LaFarge 1992 8 p Presented at the 30th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992
(Contract DE-AC04-76DP-00789)
(DE92-005181; SAND-91-1148C; CONF-920157-2) Avail: NTIS HC/MF A02

Sandia National Laboratories (SNL) launched the Los Alamos National Laboratory (LANL) sponsored ZEST flight test program from the SNL Kauai Test Facility (KTF) in the summer of 1991. The ZEST program had about 255 pounds of high explosive (HE) aboard a Talos-Castor launch vehicle. Naturally, such undertakings raise questions about the safety of personnel and the environment in the event of a premature detonation of the HE. These questions pertain not only to KTF and the island of Kauai but to the neighboring islands as well. The ability to determine realistically P(sub I), the probability of an explosively generated fragment impacting a given exclusion area, is an important factor in the safety analysis of any flight test involving explosive payloads. Once P(sub I) is known, the casualty expectations C(sub E) can be computed based on local demographics. A set of two computer codes was developed to determine P(sub I) based on computed fragment impacts. One of these codes, SAFETIE1 (Sandia Analysis of FragmEnt TrajectorIEs), computes files of trajectory initial conditions generated in a Monte Carlo sense for a set of n explosions each containing m fragments. These initial condition files are then used to compute trajectories in a parallel processing environment using a local area network (LAN) of 40 Sun workstations. This approach saves the equivalent of 40 hours of Cray YMP time. The other code, SAFETIE2, is a postprocessor that uses an AMEER output file generated by SAFETIE1, to determine how many explosions have at least one fragment in a user defined exclusion area. The average number of fragments per explosion in the exclusion area (bar N) is also computed (for C sub E considerations). DOE

N92-20681*# Alabama Univ., Huntsville.
COMPLEX BURN REGION MODULE (CBRM) UPDATE Final Technical Report, 1 Nov. 1989 - 30 Sep. 1990
Carl L. Adams and Billy Jenkins Feb. 1991 68 p
(Contract NAS8-36955)
(NASA-CR-184296; NAS 1.26:184296; UAH-5-32279) Avail: NTIS HC/MF A04 CSCL 21I

Presented here is a Complex Burn Region Module (CBRM) update for the Solid Rocket Internal Ballistics Module (SRIBM) Program for the Advanced Solid Rocket Motor (ASRM) design/performance assessments. The goal was to develop an improved version of the solid rocket internal ballistics module program that contains a diversified complex region model for motor grain design, performance prediction, and evaluation. Author

N92-20858# Sandia National Labs., Albuquerque, NM.
MONITORING JET FUEL DEGRADATION USING QUARTZ CRYSTAL MICROBALANCES
S. J. Martin, G. C. Frye, E. A. Klavetter, and A. J. Ricco 1991 8 p Presented at the American Chemical Society National Meeting, San Francisco, CA, 5-10 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-004730; SAND-91-2422C; CONF-920444-6) Avail: NTIS HC/MF A02

A sensor system using a quartz crystal microbalance (QCM) was developed to monitor, in real-time, the deposition of degradation by-products from thermally-stressed jet fuels at elevated temperatures. The QCM is an electrically excited quartz resonator that can be operated while suspended in jet fuel. The resonant frequency and damping are monitored to indicate accumulation on both crystal faces. The buildup of degradation by-products causes both a decrease in resonant frequency as well as damping of the crystal resonance. The change in resonant frequency indicates the mass density of the accumulated layer, while resonance damping arises from the viscoelastic properties of the deposit, indicating its polymeric nature. Jet A-1 and JP-8 fuels have been monitored under conditions of continuous oxygenation at 175 and 190 C for several hours, yielding average mass deposition rates of 54 and 112 ng/sq cm-min, respectively. DOE

N92-20884# Atlantic Research Corp., Gainesville, VA.
EXAMINATION OF CHEMICAL APPROACHES TO STABILIZING COMPOSITE PROPELLANT COMBUSTION Final Report, 1 Sep. 1990 - 31 Aug. 1991
Merrill K. King and R. H. Waesche 15 Oct. 1991 175 p
(Contract F49620-90-C-0067)
(AD-A244462; ARC-TR-PL-13278; AFOSR-91-1036TR) Avail: NTIS HC/MF A08 CSCL 19/1

Acoustic mode combustion instability has long plagued the solid propellant industry, and the increasingly frequent requirement for 'reduced smoke' propellants, with concommitant removal of metals from the propellant formulations (and, thus, removal of metal oxide particulate products, which have a major role in damping of acoustic oscillations) is expected to exacerbate this problem. One strategy for alleviating the problem involves identification and utilization of approaches to decreasing a major source of acoustic energy, namely, the transient burning rate response of the solid propellant to pressure and/or crossflow velocity oscillations. Previous preliminary modeling studies have indicated that it might be possible to decrease the pressure coupled response functions of composite propellants by suitable modification of the relative activation energies of the fuel and oxidizer ablation processes. GRA

N92-20958# Lawrence Livermore National Lab., CA.
UNDERSTANDING COMPOSITE EXPLOSIVE ENERGETICS. 3: REACTIVE FLOW MODELING OF ALUMINUM REACTION KINETICS IN PETN AND TNT
W. C. Tao, C. M. Tarver, and D. L. Ornellas Dec. 1991 21 p

Presented at the 2nd Beijing International Symposium on Pyrotechnics, Beijing (China), 28-31 Oct. 1991
(Contract W-7405-eng-48)
(DE92-007297; UCRL-JC-108149; CONF-9110164-2) Avail: NTIS HC/MF A03

Using Fabry-Perot interferometry techniques, we have determined the early time rate of energy release from detonating PETN and TNT explosives filled with 5 and 10 wt percent of either 5 micron or 18 micron spherical aluminum (Al) particles. From the measured particle velocity data, we are able to infer the reaction rate of aluminum with the detonation products, and calculate the extent of reaction 1 to 3 microseconds after the detonation. We observed that a substantial portion of the aluminum metal in all of the PETN and TNT formulations reacted within the timeframe of the one-dimensional experiment. In the PETN formulation filled with 5 wt percent of 5 micron aluminum, all of the metal reacted within 1.5 microseconds resulting in an increase of 22 percent in energy compared to pure PETN. A reactive-flow hydrodynamic model based on the Zeldovich-von Neumann-Doring (ZND) description of the reaction zone and subsequent reaction produce expansion (Taylor wave) is used to interpret the reaction rate of the aluminum particles with detonation product gases. The diffusion-controlled reaction mechanism for aluminum and the global kinetic parameters used in the model have been found to be consistent for all the PETN and TNT formulations. DOE

N92-20989# Lawrence Livermore National Lab., CA.
FUNDAMENTAL CHEMICAL INTERACTIONS IN METAL-FILLED COMPOSITE EXPLOSIVES
W. C. Tao, C. M. Tarver, and D. R. Breithaupt Dec. 1991 7 p
Presented at the 1991 American Physical Society (APS) Conference on Shock Compression of Condensed Matter, Williamsburg, VA, 17-20 Jul. 1991
(Contract W-7405-eng-48)
(DE92-007298; UCRL-JC-106510; CONF-9107105-57) Avail: NTIS HC/MF A02

Fabry-Perot tantalum-plate push and impedance matching transparent crystal experiments, on aluminized PETN explosives, have clearly demonstrated that some or all of the Al reacts with CO2 and/or H2O in the detonation reaction product gases during the microsecond time frame of these one-dimensional tests. A reactive flow hydrodynamic code model, based on the Zeldovich-von Neumann- Doring (ZND) description of the reaction zone and subsequent reaction product expansion (Taylor wave), is used to extract the reaction rate of the Al particles with the detonation products from the nanosecond time resolved Fabry-Perot velocity histories. Such a model for a pure explosive consists of an unreacted equation of state (EOS), a reaction product EOS, a reaction rate law for the conversion, and a set of mixture rules for the process. The addition of Al metal requires an understanding of the EOS containing unreacted Al and Al products such as Al2O3, plus the rates of Al oxidation reactions. DOE

N92-21056# Department of Energy, Washington, DC. Office of Policy, Planning, and Analysis.
ASSESSMENT OF COSTS AND BENEFITS OF FLEXIBLE AND ALTERNATIVE FUEL USE IN THE US TRANSPORTATION SECTOR
Oct. 1991 34 p
(DE92-003601; DOE/PE-0100P) Avail: NTIS HC/MF A03

The DOE is conducting a comprehensive technical analysis of a flexible fuel transportation system in the United States -- that is, a system that could easily switch between petroleum and another fuel, depending on price and availability. The DOE Alternative Fuels Assessment is aimed directly at questions of energy security and fuel availability, but covers a wide range of issues. This report examines environmental, health, and safety concerns associated with a switch to alternative- and flexible-fuel vehicles. Three potential alternatives to oil-based fuels in the transportation sector are considered: methanol, compressed natural gas (CNG), and electricity. The objective is to qualitatively describe and discuss potential environmental, health, and safety issues that would accompany widespread use of these three fuels. This report presents the results of exhaustive literature reviews; discussions with specialists in the vehicular and fuel-production industries and with federal, state, and local officials; and recent information from in-use fleet tests. Each chapter deals with the end-use and process emissions of air pollutants, presenting an overview of the potential air pollution contribution of the fuel -- relative to that of gasoline and diesel fuel -- in various applications. Carbon monoxide, particulate matter, ozone precursors, and carbon dioxide are emphasized. DOE

29 MATERIALS PROCESSING

Includes space-based development of products and processes for commercial applications.
For biological materials see *55 Space Biology*.

N92-20198*# Alabama Univ., Huntsville. Materials Processing Lab.
MATERIALS PROCESSING IN LOW GRAVITY Final Report
Gary L. Workman 19 Nov. 1991 16 p
(Contract NAS8-36955)
(NASA-CR-184280; NAS 1.26:184280) Avail: NTIS HC/MF A03 CSCL 22A

Several NASA facilities are available for low gravity experimentation: the Drop Facilities at NASA Marshall and the KC-135 at NASA Johnson. The use of these facilities allows for a rather inexpensive method of determining whether or not particular experiments will be worthwhile candidates for space experiments. Equipment currently available include various furnaces for the Drop Tube, the Drop Tower, and the KC-135. The furnaces for the Drop Tube include both an electron beam and electromagnetic levitation furnace. A vacuum furnace is used for the Drop Tower. Several furnaces used in performing KC-135 solidification experiments include the Automated Directional Solidification Furnace, the Isothermal Casting Furnace, the Rapid Melt/Rapid Quench and the Polymer/Video Furnaces. Author

N92-20214*# Clarkson Univ., Potsdam, NY. School of Engineering.
INFLUENCE OF CONVECTION ON MICROSTRUCTURE Semiannual Progress Report No. 6, 15 Feb. 1991 - 15 Feb. 1992
William R. Wilcox and Liya L. Regel 15 Feb. 1992 49 p
(Grant NAG8-753)
(NASA-CR-188618; NAS 1.26:188618) Avail: NTIS HC/MF A03 CSCL 22A

The primary motivation for this research has been to determine the cause for space processing altering the microstructure of some eutectics, especially the MnBi-Bi eutectic. Prior experimental research at Grumman and here showed that the microstructure of MnBi-Bi eutectic is twice as fine when solidified in space or in a magnetic field, is uninfluenced by interfacial temperature gradient, adjusts very quickly to changes in freezing rate, and becomes coarser when spin-up/spin-down (accelerated crucible rotation technique) is used during solidification. Theoretical work at Clarkson predicted that buoyancy driven convection on earth could not account for the two fold change in fiber spacing caused by solidification in space. However, a lamellar structure with a planar interface was assumed, and the Soret effect was not included in the analysis. Experimental work at Clarkson showed that the interface is not planar, and that MnBi fibers project out in front of the Bi matrix on the order of one fiber diameter. Originally four primary hypotheses were to be tested under this current grant: (1) a fibrous microstructure is much more sensitive to convection than a lamellar microstructure, which was assumed in our prior theoretical treatment; (2) an interface with one phase projecting out into the melt is much more sensitive to convection than a planar interface, which was assumed in our prior theoretical treatment; (3) the Soret effect is much more important in the absence of convection and has a sufficiently large influence on microstructure that its action can explain the flight results; and (4) the microstructure is much more sensitive to convection when the

composition of the bulk melt is off eutectic. As reported previously, we have learned that while a fibrous microstructure and a non-planar interface are more sensitive to convection than a lamellar microstructure with a planar interface, the influence of convection remains too small to explain the flight and magnetic field results. Similarly addition of the Soret effect does not explain the flight and magnetic field results. Author

N92-20234*# National Aeronautics and Space Administration, Washington, DC.
MICROGRAVITY SCIENCE AND APPLICATIONS BIBLIOGRAPHY, 1991 REVISION
Feb. 1992 70 p
(NASA-TM-4348; NAS 1.15:4348) Avail: NTIS HC/MF A04 CSCL 22A

This edition of the Microgravity Science and Applications (MSA) Bibliography is a compilation of government reports, contractor reports, conference proceedings, and journal articles dealing with flight experiments utilizing a low-gravity environment to elucidate and control various processes, or with ground-based activities that provide supporting research. It encompasses literature published but not cited in the 1990 Revision and that literature which has been published in the past year. The following topics are included as the subdivisions of the Bibliography: Electronic Materials; Metals, Alloys, and Composites; Fluids, Interfaces, and Transport; Glasses and Ceramics; Biotechnology; Combustion Science; and Experimental Technology, Instrumentation, and Facilities. Also included are a limited number of publications from the European, Soviet, and Japanese programs. Author

N92-20373*# Alabama Univ., Huntsville. Center for Microgravity and Materials Research.
RESIDUAL ACCELERATION DATA ON IML-1: DEVELOPMENT OF A DATA REDUCTION AND DISSEMINATION PLAN Annual Progress Report No. 3, 1 Mar. 1991 - 29 Feb. 1992
Melissa J. B. Rogers, J. Iwan D. Alexander, and Randy Wolf 29 Feb. 1992 32 p
(Grant NAG8-759)
(NASA-CR-189907; NAS 1.26:189907) Avail: NTIS HC/MF A03 CSCL 12A

The main thrust of our work in the third year of contract NAG8-759 was the development and analysis of various data processing techniques that may be applicable to residual acceleration data. Our goal is the development of a data processing guide that low gravity principal investigators can use to assess their need for accelerometer data and then formulate an acceleration data analysis strategy. The work focused on the flight of the first International Microgravity Laboratory (IML-1) mission. We are also developing a data base management system to handle large quantities of residual acceleration data. This type of system should be an integral tool in the detailed analysis of accelerometer data. The system will manage a large graphics data base in the support of supervised and unsupervised pattern recognition. The goal of the pattern recognition phase is to identify specific classes of accelerations so that these classes can be easily recognized in any data base. The data base management system is being tested on the Spacelab 3 (SL3) residual acceleration data.
Author

31 ENGINEERING (GENERAL)

Includes vacuum technology; control engineering; display engineering; cryogenics; and fire prevention.

N92-20049# Midwest Research Inst., Golden, CO.
IMPACT OF AMBIENT PRESSURE ON PERFORMANCE OF DESICCANT COOLING SYSTEMS
A. A. Pesaran Dec. 1991 14 p Presented at the International Solar Energy Conference, Honolulu, HI, 4-8 Apr. 1992
(Contract DE-AC02-83CH-10093)
(DE92-001180; NREL/TP-254-4601; CONF-920429-1) Avail: NTIS HC/MF A03

The impact of ambient pressure on the performance of the ventilation cycle desiccant cooling system and its components was studied using computer simulations. The impact of ambient pressure depended on whether the system was designed for fixed-mass flow rate or fixed-volume flow rate operation. As ambient pressure decreased from 1.0 to 0.8 atm, the system thermal coefficient of performance increased by 8 pct. for both fixed-mass and fixed-volume flow rate, the cooling capacity of the system (in kW) was decreased by 14 pct. for the fixed-volume flow rate system and increased by 7 pct. for the fixed-mass flow rate system, the electric power requirements for the system with fixed-volume flow rate did not change, and the electric power requirement for the fixed-mass flow rate system increased by 44 pct. The overall coefficient of performance increased up to 5 pct. for the fixed-volume flow rate systems, and decreased up to 4 pct. for the fixed-mass flow rate system. DOE

N92-20107# National Inst. of Standards and Technology, Boulder, CO. Thermophysics Div.
A SURVEY OF CURRENT WORLDWIDE RESEARCH ON THE THERMOPHYSICAL PROPERTIES OF ALTERNATIVE REFRIGERANTS
M. O. McLinden, W. M. Haynes, J. T. R. Watson, and K. Watanabe (Keio Univ., Yokahama, Japan) Jun. 1991 82 p Sponsored by DOE
(PB92-112366; NISTIR-3969) Avail: NTIS HC/MF A05 CSCL 13B

The survey represents an exhaustive compilation of the research activities throughout the world concerned with either measurements or correlations of the thermophysical properties of alternative refrigerants. The properties covered include thermodynamic, transport, phase equilibria, and other properties such as dielectric constant and refractive index. The survey included a wide range of fluids (including R23, R32, R125, R143a, R22, R134a, R152a, R134, R124, R142b, R123, R123a, R141b) along with mixtures containing at least one of these fluids. Summary information is presented in tabular form about each research activity; the survey does not present raw data or correlating equations. Author

N92-20252# National Inst. of Standards and Technology, Gaithersburg, MD.
UNIFORM LAWS AND REGULATIONS AS ADOPTED BY THE 76TH NATIONAL CONFERENCE ON WEIGHTS AND MEASURES, 1991 (1992 EDITION)
Carroll S. Brickenkamp, ed. and Joan A. Koenig, ed. Oct. 1991 173 p
(PB92-112416; NIST/HB-130) Avail: NTIS HC/MF A08; also available SOD HC $11.00 as 003-003-03105-4 CSCL 13B

The handbook, which is revised annually, compiles the uniform laws and regulations developed by the Committee on Laws and Regulations of the National Conference on Weights and Measures (NCWM). The compilation itself was approved by the NCWM in 1979, and the edition itself includes amendments adopted by the Conference at its annual meeting in 1991. The edition also contains an updated reprint of Section 2 from NCWM Publication 3, 'Policy, Interpretations, and Guidelines.' The NCWM recommends adoption and promulgation by the States of these uniform laws and regulations as updated in the handbook. Author

N92-20313# National Inst. of Standards and Technology, Gaithersburg, MD.
SPECIFICATIONS, TOLERANCES, AND OTHER TECHNICAL REQUIREMENTS FOR WEIGHING AND MEASURING DEVICES AS ADOPTED BY THE 76TH NATIONAL CONFERENCE ON WEIGHTS AND MEASURES, 1991 (1992 EDITION)
Henry V. Oppermann, ed. Oct. 1991 214 p
(PB92-112424; NIST/HB-44) Avail: NTIS HC/MF A10; also available SOD HC $12.00 as 003-003-03114-3 CSCL 13B

Handbook 44 was first published in 1949, having been preceded by similar handbooks of various designations and in several forms beginning in 1918. The 1992 edition was developed by the Committee on Specifications and Tolerances of the National Conference on Weights and Measures with the assistance of the

Office of Weights and Measures of the National Institute of Standards and Technology. It includes amendments adopted by the 76th annual meeting of the National Conference on Weights and Measures in 1991. Handbook 44 is published in its entirety each year following the annual meeting of the National Conference on Weights and Measures. Author

N92-20315# National Inst. of Standards and Technology, Gaithersburg, MD.
REPORT OF THE 76TH NATIONAL CONFERENCE ON WEIGHTS AND MEASURES, 1991 Final Report
Carroll S. Brickenkamp, ed. and Ann H. Turner, ed. Sep. 1991 374 p Conference held in Philadelphia, PA, 14-19 Jul. 1991
(PB92-112465; NIST/SP-816; LC-26-27766) Avail: NTIS HC/MF A16 CSCL 13B

In the address to the delegates, Chairman David Smith mentioned the progress made in fuel quality inspection program; the new joint Federal Grain Inspection Service and NCWM joint program; the National Type Evaluation Program; and the need for State metrology. Special meetings included those of the Metrologists, the Associate Membership Committee, the Retired Officials Committee, the Scale Manufacturers' Association, the American Petroleum Institute, the Industry Committee on Packaging and Labeling, the State regional weights and measures associations, and the National Association of State Depts. of Agriculture Weights and Measures Div., and the National Council on State Metrication. Reports by the standing and annual committees of the Conference comprise the major portion of the publication, along with the addresses delivered by Conference officials and other authorities from government and industry. Author

N92-20341# Oak Ridge National Lab., TN.
BENCHMARK PERFORMANCE ANALYSIS OF AN ECM-MODULATED AIR-TO-AIR HEAT PUMP WITH A RECIPROCATING COMPRESSOR
C. K. Rice Jan. 1992 40 p Presented at the International Air Conditioning, Heating, Refrigerating Exposition, Anaheim, CA, 25-29 Jan. 1992
(Contract DE-AC05-84OR-21400)
(DE92-004478; CONF-920108-2) Avail: NTIS HC/MF A03

A benchmark analysis was conducted to predict the maximum steady- state performance potential of a near-term modulating residential- size heat pump. Continuously variable-speed, permanent-magnet electronically commutated motors (ECMs) were assumed to modulate the compressor and the indoor and outdoor fans in conjunction with existing modulating reciprocating compressor technology. A modulating heat pump design tool was used to optimize this ECM benchmark heat pump, using speed ranges and total heat exchanger sizes per-unit-capacity equivalent to that used by the highest SEER-rated variable-speed unit presently on the market (SEER = 16.4). Parametric steady-state performance optimization was conducted at a nominal design cooling ambient of 95 F (35 C) and at three off-design ambients of 82 F (27.8 C) cooling and 47 F and 17 F (8.3 C and minus 8.3 C) heating. In comparison to the reference commercially available residential unit, the analysis for the ECM benchmark predicted steady-state heating COPs about 35 percent higher and a cooling EER almost 25 percent higher at the nominal design cooling condition. The cooling EER at 82 F (27.8 C) was 13 percent higher than that of the reference unit when a comparable sensible heat ratio of 0.71 was maintained, while an EER gain of 24 percent at the 82 F (27.8 C) rating point was predicted when the sensible heat ratio was relaxed to 0.83. DOE

N92-20384# Institut National des Sciences Appliquees de Lyon, Villeurbanne (France).
A PRODUCTION SYSTEMS DESIGN AID BASED ON DATA SIMULATION AND ANALYSIS, VOLUME 1 Ph.D. Thesis [UNE AIDE A LA CONCEPTION DE SYSTEMES DE PRODUCTION BASEE SUR LA SIMULATION ET L'ANALYSE DE DONNEES (VOLUME 1)]
Christine Heritier-Pingeon 1991 246 p In FRENCH
(ISAL-91-0020-Vol-1; ETN-92-90855) Avail: NTIS HC/MF A11

The need for production systems to be increasingly flexible is stressed. In the case of automated systems, decisions made early on in the conception phase will greatly effect the future possibilities of the system as well as its ability to adapt to changes. Decision making tools and methods are studied. The workshop model used as the basis for the study is presented. Knowledge acquisition methods and their effect on the behavior and performance of production systems is studied. An analytic method is proposed and used experimentally. The results of the experimental application are presented. ESA

N92-20391# Technische Univ., Delft (Netherlands). Faculty of Mechanical Engineering and Marine Technology.
MODELLING OF A REFRIGERATING SYSTEM COUPLED WITH A REFRIGERATED ROOM Ph.D. Thesis
Hongwei Wang 1991 249 p
(ISBN-90-370-0051-7; ETN-92-90878) Copyright Avail: NTIS HC/MF A11

The development of a set of comprehensive computer models to simulate and analyze both steady state and non steady state behavior of a refrigerating system coupled with a refrigerated room is described. The refrigerating system is a single stage vapor compression system consisting of four basic elements: a reciprocating piston compressor, a dry expansion evaporator (or cooler), a shell and tube watercooled condensor and a thermostatic expansion valve. To validate the computer models, a test plant on which steady state and dynamic measurements were carried out, was set up. Experiments to determine several empirical constants encountered in the models were done, and the simulation results were compared with a series of measurements within a wide range of operation conditions. The validated models were applied to the prediction of the air distributions in a cold store and the study of a system with different capacity control systems, proving the capability and reliability of the models. ESA

N92-20450# National Inst. of Standards and Technology, Gaithersburg, MD.
INTERPRETATION OF THE SI FOR THE UNITED STATES AND METRIC CONVERSION POLICY FOR FEDERAL AGENCIES Final Report
B. N. Taylor Oct. 1991 20 p
(PB92-126572; NIST/SP-814) Avail: NTIS HC/MF A03 CSCL 20C

The National Institute of Standards and Technology (NIST) Special Publication replaces National Bureau of Standards (NBS) Letter Circular LC1132 published April 19, 1982. It reprints the Department of Commerce, NIST, Federal Register notice of December 20, 1990 titled 'Metric System Measurement; Interpretation of the International System of Units for the United States' (the International System of Units, abbreviated SI, is the modernized metric system); the Department of Commerce, Office of the Secretary. Federal Register notice of January 2, 1991 titled 'Metric Conversion Policy for Federal Agencies'; and Executive Order 12770 issued by the President of the United States on July 25, 1991 titled 'Metric Usage in Federal Government Programs.' The first Federal Register notice restates the Department of Commerce's interpretation of the International System of Units for the United States that was last published by the Department in 1982; the second revises the Code of Federal Regulations (CFR) to remove the voluntary aspect of the conversion to the metric system of measurement for Federal agencies; and the Executive Order provides Presidential authority and direction for the use of the metric system of measurement by Federal departments and agencies in their programs. Also included is a diagram that shows graphically how the 19 SI derived units with special names are derived in a coherent manner from the SI base and supplementary units. GRA

N92-20639# European Space Agency, Paris (France).
MANUFACTURE AND MEASUREMENT OF LOW LOSS AND LOW SCATTER LASER MIRRORS

Dirk-Roger Schmitt Aug. 1991 205 p Transl. into ENGLISH of Herstellung und Messung Verlust- und Streulichtarmer Laserspiegel (Brunswick, Fed. Republic of Germany), Aug. 1990 185 p Original language document was announced as N91-11951
(ESA-TT-1239; DLR-FB-90-19; ETN-92-90743) Avail: NTIS HC/MF A10; original German version available from DLR, Wissenschaftliches Berichtswesen, VB-PL-DO, Postfach 90 60 58, 5000 Cologne, Fed. Republic of Germany, HC 68 deutsche marks

High reflectance and low scatter laser mirrors were developed for laser gyro applications. Using a novel scatterometer and a modified differential interference contrast process, it was possible to produce superpolished surfaces having roughnesses of 0.1 nm. Dielectric systems of layers of TiO2/SiO2, Ag/TiO2/SiO2, Ta2O5/SiO2, and PrTiO/SiO2 were used. This resulted in reflectivities of better than 0.9995. The lowest value for integrated scattered light was 0.0001 and was obtained by means of the PrTiO3/SiO2 system. The dielectric multilayer systems developed were also used in modified form for producing edge filters for GaAs based optical modulators. ESA

N92-20646# National Inst. of Standards and Technology, Gaithersburg, MD.
GUIDE FOR THE USE OF THE INTERNATIONAL SYSTEM OF UNITS: THE MODERNIZED METRIC SYSTEM Final Report
A. O. McCoubrey Sep. 1991 39 p
(PB92-116383; NIST/SP-811) Avail: NTIS HC/MF A03; also available SOD HC $2.50 as 003-003-03113-5 CSCL 13B

Given here is a practical tool for the use of authors in the preparation of technical manuscripts in conformance with the National Institute of Standards and Technology (NIST) policy that requires the use of the International System of Units (SO) for all publications. Author

N92-20814# National Inst. of Standards and Technology, Gaithersburg, MD.
DATA FOR FIRE HAZARD ASSESSMENT OF SELECTED NON-HALOGENATED AND HALOGENATED FIRE RETARDANTS: REPORT OF TEST FR 3983
R. H. Harris, V. Babrauskas, B. C. Levin, and M. Paabo Oct. 1991 56 p Sponsored in part by Huber (J. M.) Corp., Norcross, GA, and Aluminum Co. of America, Alcoa Center, PA
(PB92-112473; NISTIR-4649) Avail: NTIS HC/MF A04 CSCL 13B

Five plastic materials, with and without fire retardants, were studied to compare the fire hazards of non-halogenated fire retardant additives with halogenated flame retardents. The plastic materials were identified by the sponsors as unsaturated polyesters, thermoplastic high density, low density and cross-linked low density polyethylenes, polypropylene, flexible and rigid poly(vinyl chlorides), and cross-linked and thermoplastic ethylene-vinyl acetate copolymers. The non-halogenated fire retardants tested were aluminum hydroxide, also known as alumina trihydrate, sodium alumino-carbonate, and magnesium hydroxide. The halogenated flame retardants were chlorine or bromine/antimony oxides. The plastics were studied using the Cone Calorimeter and the cup furnace smoke toxicity method (high density polyethylene only). The Cone Calorimeter provided data on mass consumed; time to ignition; peak rate and peak time of heat release; total heat release; effective heat of combustion; average yields of CO, CO2, HCl, and HBr; and average smoke obscuration. The concentrations of toxic gases generated in the cup furnace smoke toxicity method were used to predict the toxic potency of the mixed thermal decomposition products. The data from the Cone Calorimeter indicate that the non-halogenated fire retardants were, in most of the tested plastic formulations, more effective than the halogenated flame retardants in increasing the time to ignition. The non-halogenated fire retardants were also more effective in reducing the mass consumed, peak rate of heat release, total heat released, and effective smoke produced. The use of halogenated flame retardants increased smoke production and CO yields and, additionally, produced the known acid gases and toxic irritants, HCl and HBr, in measureable quantities. Author

N92-20865# Utrecht State Univ. (Netherlands). Dept. of Computer Science.
EFFICIENT HIDDEN SURFACE REMOVAL FOR OBJECTS WITH SMALL UNION SIZE
Matthew J. Katz, Mark H. Overmars, and Micha Sharir (Tel-Aviv Univ., Israel) Aug. 1991 15 p Sponsored in part by Commission of the European Communitie; Netherlands Organization for Applied Scientific Research TNO; German-Israeli Foundation for Scientific Research and Development; US-Israeli Binational Science Foundation: and Israeli Academy of Sciences Fund for Basic Research
(Contact N00014-90-J-1284; NSF CCR-89-01484)
(RUU-CS-91-31; ISSN-0924-3275; ETN-92-91098) Avail: NTIS HC/MF A03

Let S be a set of n nonintesecting objects in space for which determination of the portions visible from some viewing point is required. The objects are assumed to be ordered by depth from the viewing point (e.g., they are all horizontal and are viewed from infinity from above). An algorithm that computes the visible portions in time O((U(n)+k)(log squared)n) is given, where U(n') is a super additive bound on the maximal complexity of the union of (the projections in a viewing plane of) any n' objects from the family under consideration, and k is the complexity of the resulting visibility map. The algorithm uses O(U(n)log n) working storage. The algorithm is useful when the objects are 'fat' in the sense that the union of the projection of any subset of them have small (i.e., subquadratic) complexity. Three applications of this general technique are presented: for disks (or balls in space), U(n) O(n), thus the visibility map can be computed in time O((n+k)(Log squared) n); for 'fat' triangles (where each internal angle is at least some fixed theta degrees), U(n) = O(n loglog n) and the algorithm runs in time O((n loglog n+k) (log squared) n); the method also applies to computing the visibility map for a polyhedral terrain viewed from a fixed point, and yields an O((n alpha(n) + k) log n) algorithm. ESA

32 COMMUNICATIONS AND RADAR

Includes radar; land and global communications; communications theory; and optical communications.

For related information see also *04 Aircraft Communications and Navigation* and *17 Space Communications, Spacecraft Communications, Command and Tracking.* For search and rescue see *03 Air Transportation and Safety,* and *16 Space Transportation.*

N92-20077# Delta Information Systems, Inc., Horsham, PA.
ANALYSIS OF GOVERNMENT FACSIMILE EQUIPMENT AND NETWORKS Final Report
May 1991 114 p
(Contract DCA100-87-C-0078)
(AD-A243139; NCS-TIB-90-19) Avail: NTIS HC/MF A06 CSCL 25/5

The purpose of this task is to investigate strategic and tactical facsimile equipments and networks employed by the Federal Government (including both those currently in the field and those due for deployment in the near future), determine their characteristics in terms of interoperability and compatibility, and, in those instances where incompatibilities are determined, to recommend how they might be made to interoperate. The Federal government uses a wide range of facsimile equipment and networks ranging from commercial, off-the-shelf equipments designed for the office to special ruggedized equipment designed for the battlefield. In general, those equipment fall into two categories: strategic and tactical. Strategic equipments are used in office-like surroundings where the environment is usually well controlled, and operate over networks like the Public Switched Telephone Network (PTN) and the Defense Communications Network (DCN). Two examples of strategic equipments are off-the-shelf, commercially available facsimile equipments (Group 3, etc.) and commercially available equipments modified to communicate through encryption devices. GRA

N92-20157# Defence Research Establishment, Ottawa (Ontario). Communications Electronic Warfare Section.
AN ANALYSIS OF COMPLEX DOWN MIXING, FILTERING, AND DECIMATION IN ACES
Eric April Jan. 1991 34 p
(DREO-91-2; CTN-92-60434) Avail: NTIS HC/MF A03

This report elaborates on a system which reduces the sampling rate of a signal coming from a digital wideband receiver of 4 MHz bandwidth and isolates, in frequency, the bandwidth of interest. The system is called the mixing, filtering and decimation system (MFDS) and supports research into the Advanced Communications Electronic Support Measures System (ACES). Three parameters were considered in the choice of digital filters to be used: (1) the transition width defined as the spectral region going from the passband to the stopband; (2) the stopband attenuation; and (3) preservation of the phase linearity of the filter. From these specifications, a finite impulse response (FIR) filter using a Kaiser window weighting function with 255 taps was selected. Analysis of the overall system led to the need (mainly due to filter limitations) for two decimation operations such that a new lower sampling frequency was defined. Three elements of design are discussed: (1) how to build a complex bandpass filter; (2) how to perform a complex down mixing using complex bandpass filters; and (3) under which conditions a decimation operation has to be performed in order to prevent aliasing. CISTI

N92-20158# Defence Research Establishment Pacific, Victoria (British Columbia).
A BIDIRECTIONAL FIBER OPTIC COMMUNICATION SYSTEM
George K. Schattschneider Jun. 1991 26 p
(DREP-91-09; CTN-92-60435) Avail: NTIS HC/MF A03

A novel bidirectional fiber optic communication system has been designed and developed at the Defence Research Establishment Pacific (DREP). It is part of a new magnetic anomaly detection (MAD) system currently under development by the MAD group. The fiber optic system is designed to transfer asynchronous data through a single optical fiber between an aircraft and a tethered bird. Low magnetic content, minimal size and weight, low power consumption, and wide temperature range operation of the bird section of the system are requirements that are critical to the proper functioning of the entire MAD system. The communication system described in this paper meets all of these requirements as well as providing exceptional accuracy and reliability. Author (CISTI)

N92-20159# Defence Research Establishment, Ottawa (Ontario). Communications Electronic Warfare Section.
MODULATION RECOGNITION: AN OVERVIEW
Rene Lamontagne Mar. 1991 69 p
(DREO-91-3; CTN-92-60436) Avail: NTIS HC/MF A04

A review is presented of techniques proposed in the open literature for automatic identification of the modulation type of an intercepted radio signal. Most of these techniques are based on the same classic pattern recognition theory, presented in a separate section as a prerequisite to understanding the following sections. The two main classification techniques for modulation recognition, the linear classifier and the decision tree, are more specifically discussed. Since the main differences among the approaches proposed by the referred authors are the features they used, the main part of the review consists of presenting these features and the corresponding performance results. Both analog as well as digital modulation types are considered, as well as specific points such as preprocessing to remove gaps in analog amplitude modulated signals. Author (CISTI)

N92-20160# Defence Research Establishment, Ottawa (Ontario). Communications Electronic Warfare Section.
COMMUNICATIONS ELECTRONIC COUNTERMEASURES: AN OVERVIEW
Janette D. Hooper Dec. 1990 96 p
(DREA-1074; CTN-92-60437) Avail: NTIS HC/MF A05

This report presents a review of the requirements and methods for technically effective communications jamming. An equation to determine technical jamming effectiveness is introduced. The equation allows calculation of the jammer to signal (J/S) ratio at the target receiver. The equation requires knowledge of the jammer power and the power of the target transmitter, the antenna gains over the jammer receiver link and the transmitter receiver link, and the path loss between the jammer and receiver, and the transmitter and receiver. There is an overview of the methods to determine path loss. If the J/S ratio required to jam a link is calculated, the technical effectiveness for a particular jamming scenario can be determined because thresholds of J/S ratio required for jamming are tabulated. An overview of the types of communications electronic countermeasures, their implementations, and their problems is also included. Both jamming and deception techniques are discussed. Author (CISTI)

N92-20189# Carleton Univ., Ottawa (Ontario). Inst. for Electrical Engineering.
MULTIPATH RESOLUTION USING A ROTATABLE DUAL-POLARIZATION ANTENNA FOR DIRECTION FINDING Thesis Final Report
Lana D. Teany Dec. 1990 27 p Sponsored by Defence Research Establishment
(DREO-91-611; DOE-90-09; CTN-92-60424) Avail: NTIS HC A08

The attainable accuracy of current direction finding (DF) systems is limited, primarily due to the wavefront distortion resulting from multipath (MP) propagation. A technique which exploits the polarization content of a waveform is proposed in this report as a means of obtaining a more accurate estimate of direction of arrival (DOA) bearings. A rotatable dual polarization very high frequency (VHF) direction finding antenna was designed and fabricated to measure the polarization diversity of a signal wavefront. Its operation is based on a null-steering amplitude comparison technique. The antenna was tested in a controlled set of MP field measurements and the experimental results were analyzed using a proposed DF correlation technique. Results indicate that this technique appears feasible for the estimation of transmitter bearings in scenarios involving a single MP signal. Author (CISTI)

N92-20197*# Ohio State Univ., Columbus. ElectroScience Lab.
BISTATIC IMAGE PROCESSING FOR A 32 X 19 INCH MODEL AIRCRAFT USING SCATTERED FIELDS OBTAINED IN THE OSU-ESL COMPACT RANGE
T-H. Lee and W. D. Burnside Feb. 1992 131 p
(Grant NAG2-542)
(NASA-CR-189932; NAS 1.26:189932; Rept-722780-3) Avail: NTIS HC/MF A07 CSCL 20N

Inverse Synthetic Aperture Radar (ISAR) images for a 32 in long and 19 in wide model aircraft are documented. Both backscattered and bistatic scattered fields of this model aircraft were measured in the OSU-ESL compact range to obtain these images. The scattered fields of the target were measured for frequencies from 2 to 18 GHz with a 10 MHz increment and for full 360 deg azimuth rotation angles with a 0.2 deg step. For the bistatic scattering measurement, the compact range was used as the transmitting antenna; while, a broad band AEL double ridge horn was used as the receiving antenna. Bistatic angles of 90 deg and 135 deg were measured. Due to the size of the chamber and target, the receiving antenna was in the near field of the target; nevertheless, the image processing algorithm was valid for this case. Author

N92-20223# Office of Radiation Programs, Las Vegas, NV.
ELECTRIC AND MAGNETIC FIELDS NEAR AM BROADCAST TOWERS Final Report
E. Mantiply and R. F. Cleveland Jul. 1991 89 p
(PB92-101427; EPA/520/6-91/020) Avail: NTIS HC/MF A05 CSCL 20N

Real measurement data were obtained in the close-in near field of representative AM broadcast antennas and the data was compared to values predicted by a Numerical Electromagnetic Code (NEC) model. Measurements of electric and magnetic fields were made along several radial directions at distances from 1 to 100

m from the transmitting towers of eight AM broadcast stations. These stations operated at various frequencies, electrical heights, and power outputs. Author

N92-20273*# Pennsylvania State Univ., University Park. Dept. of Electrical and Computer Engineering.
USER'S MANUAL FOR THREE DIMENSIONAL FDTD VERSION D CODE FOR SCATTERING FROM FREQUENCY-DEPENDENT DIELECTRIC AND MAGNETIC MATERIALS
John H. Beggs, Raymond J. Luebbers, and Karl S. Kunz Jan. 1992 45 p
(Grant NAG1-1221)
(NASA-CR-190110; NAS 1.26:190110) Avail: NTIS HC/MF A03 CSCL 20N

The Penn State Finite Difference Time Domain Electromagnetic Scattering Code version D is a 3-D numerical electromagnetic scattering code based upon the finite difference time domain technique (FDTD). The manual provides a description of the code and corresponding results for several scattering problems. The manual is organized into 14 sections: introduction; description of the FDTD method; operation; resource requirements; version D code capabilities; a brief description of the default scattering geometry; a brief description of each subroutine; a description of the include file; a section briefly discussing Radar Cross Section computations; a section discussing some scattering results; a sample problem setup section; a new problem checklist; references and figure titles. The FDTD technique models transient electromagnetic scattering and interactions with objects of arbitrary shape and/or material composition. In the FDTD method, Maxwell's curl equations are discretized in time-space and all derivatives (temporal and spatial) are approximated by central differences.
Author

N92-20336# National Telecommunications and Information Administration, Boulder, CO. Inst. for Telcommunication Sciences.
SPECTRUM USAGE MEASUREMENTS IN POTENTIAL PCS FREQUENCY BANDS
J. A. Wepman, R. J. Matheson, K. C. Allen, and R. J. Achatz Sep. 1991 165 p Sponsored in part by Telesis Technology Lab., Inc., Walnut Creek, CA
(PB92-123819; NTIA-91-279) Avail: NTIS HC/MF A08 CSCL 17B

Spectrum usage measurements were made in several potential Personal Communication Services (PCS) frequency bands in the 600 to 2600 MHz range in five U.S. cities. Geographic dependence (within a city) of spectrum usage was determined for all of the cities. Measurements were made using a mobile, computer-controlled, automated radio frequency measurement system that was installed in a mini-van. The raw data taken at each site consisted of received signal levels for each frequency measured. These were processed to provide signal level, measured frequency usage, and measured band usage graphs. The heaviest usage for all cities was seen in the 869-894 MHz band. The frequency bands showing the least usage in all cities were the 901-902 MHz, 1850-1990 MHz, and the 2400-2483.5 MHz bands.
GRA

N92-20404*# Johns Hopkins Univ., Laurel, MD. Applied Physics Lab.
PROPAGATION EFFECTS FOR LAND MOBILE SATELLITE SYSTEMS: OVERVIEW OF EXPERIMENTAL AND MODELING RESULTS
Julius Goldhirsh and Wolfhard J. Vogel Feb. 1992 142 p Prepared in cooperation with Texas Univ., Austin
(NASA-RP-1274; NAS 1.61:1274) Avail: NTIS HC/MF A07 CSCL 20N

Models developed and experiments performed to characterize the propagation environment associated with land mobile communication using satellites are discussed. Experiments were carried out with transmitters on stratospheric balloons, remotely piloted aircraft, helicopters, and geostationary satellites. This text is comprised of compiled experimental results for the expressed use of communications engineers, designers of planned Land Mobile Satellite Systems (LMSS), and modelers of propagation effects. The results presented here are mostly derived from systematic studies of propagation effects for LMSS geometries in the United States associated with rural and suburban regions. Where applicable, the authors also draw liberally from the results of other related investigations in Canada, Europe, and Australia. Frequencies near 1500 MHz are emphasized to coincide with frequency bands allocated for LMSS by the International Telecommunication Union, although earlier experimental work at 870 MHz is also included.
Author

N92-20427# National Inst. of Standards and Technology, Boulder, CO. Electromagnetic Technology Div.
MODIFIED AIRY FUNCTION AND WKB SOLUTIONS TO THE WAVE EQUATION
A. K. Ghatak, R. L. Gallawa, and I. C. Goyal Nov. 1991 175 p Prepared in cooperation with Indian Inst. of Tech., New Delhi
(PB92-126531; NIST/MONO-176) Avail: NTIS HC/MF A08; also available SOD HC $5.50 as 003-003-03123-2 CSCL 20N

The Wentzel-Kramer-Brillouin (WKB) method has served in problems of quantum mechanics and nonuniform optical waveguides, the discipline treated in the monograph. The monograph discusses the WKB and the Modified Airy Function (MAF) methods in considerable detail, to the end that the reader gains an appreciation of the strengths and weaknesses of each. The authors treat eigenvalue problems as well as initial value problems. The two methods could be illustrated via any of several disciplines, but they choose to use problems that are of current interest in the optical waveguide community. They have also used Schrodinger's equation for typical potential well problems to further illustrate the method. Both the wave functions and the eigenvalues are found. They have also included several exercises to be solved by the reader. They give several examples to illustrate the method for problems of interest in optical telecommunications devices.
GRA

N92-20442*# Pennsylvania State Univ., University Park. Dept. of Electrical Engineering.
FINITE DIFFERENCE TIME DOMAIN CALCULATIONS OF ANTENNA MUTUAL COUPLING
Raymond J. Luebbers and Karl S. Kunz Apr. 1991 15 p
(Grant NAG1-1221)
(NASA-CR-190100; NAS 1.26:190100) Avail: NTIS HC/MF A03 CSCL 20N

The Finite Difference Time Domain (FDTD) technique was applied to a wide variety of electromagnetic analysis problems, including shielding and scattering. However, the method has not been exclusively applied to antennas. Here, calculations of self and mutual admittances between wire antennas are made using FDTD and compared with results obtained during the method of moments. The agreement is quite good, indicating the possibilities for FDTD application to antenna impedance and coupling.
Author

N92-20469# Toronto Univ. (Ontario).
EXPERIMENT ON A THREE-BEAM ADAPTIVE ARRAY FOR EHF FREQUENCY-HOPPED SIGNALS USING A FAST ALGORITHM, PHASE E Annual Report
J. L. Yen, P. Kremer, and J. Fung 31 May 1990 15 p Sponsored by Communications Research Centre
(CTN-92-60443) Avail: NTIS HC/MF A03

The Department of National Defence (Canada) has been conducting studies into multi-beam adaptive arrays for extremely high frequency (EHF) frequency hopped signals. A three-beam 43 GHz adaptive antenna and a beam control processor is under development. An interactive software package for the operation of the array, capable of applying different control algorithms is being written. A maximum signal to jammer plus noise ratio (SJNR) has been found to provide superior performance in preventing degradation of user signals in the presence of nearby jammers. A new fast algorithm using a modified conjugate gradient approach has been found to be a very efficient way to implement anti-jamming

arrays based on maximum SJNR criterion. The present study was intended to refine and simplify this algorithm and to implement the algorithm on an experimental array for real-time evaluation of anti-jamming performance. A three-beam adaptive array was used. A simulation package was used in the evaluation of multi-beam systems using more than three beams and different user-jammer scenarios. An attempt to further reduce the computation burden through further analysis of maximum SJNR met with limited success. The investigation of a new angle detector for spatial tracking in heterodyne laser space communications was completed. CISTI

N92-20486*# Pennsylvania State Univ., University Park. Dept. of Electrical and Computer Engineering.
USER'S MANUAL FOR TWO DIMENSIONAL FDTD VERSION TEA AND TMA CODES FOR SCATTERING FROM FREQUENCY-INDEPENDENT DIELECTRIC MATERIALS
John H. Beggs, Raymond J. Luebbers, and Karl S. Kunz Nov. 1991 19 p
(Grant NAG1-1221)
(NASA-CR-190104; NAS 1.26:190104) Avail: NTIS HC/MF A03 CSCL 20N

The Penn State Finite Difference Time Domain Electromagnetic Scattering Code Versions TEA and TMA are two dimensional electromagnetic scattering codes based on the Finite Difference Time Domain Technique (FDTD) first proposed by Yee in 1966. The supplied version of the codes are two versions of our current FDTD code set. This manual provides a description of the codes and corresponding results for the default scattering problem. The manual is organized into eleven sections: introduction, Version TEA and TMA code capabilities, a brief description of the default scattering geometry, a brief description of each subroutine, a description of the include files (TEACOM.FOR TMACOM.FOR), a section briefly discussing scattering width computations, a section discussing the scattering results, a sample problem setup section, a new problem checklist, references, and figure titles. Author

N92-20534# Canadian Marconi Co., Montreal (Quebec). Avionics Div.
DESIGN SPECIFICATION OF AN ACOUSTO-OPTIC SPECTRUM ANALYZER THAT COULD BE USED AS AN AUXILIARY RECEIVER FOR CANEWS Final Report
John Studenny and Eric Johnstone Jan. 1991 492 p
(CTN-92-60446) Avail: NTIS HC A21

The acousto-optic spectrum analyzer has undergone a theoretical design review and a basic parameter tradeoff analysis has been performed. The main conclusion is that for the given scenario of a 55 dB dynamic range and for a one-second temporal resolution, a 3.9 MHz resolution is a reasonable compromise with respect to current technology. Additional configurations are suggested. Noise testing of the signal detection processor algorithm was conducted. Additive white Gaussian noise was introduced to pure data. As expected, the tradeoff was between algorithm sensitivity and false alarms. No additional algorithm improvements could be made. The algorithm was observed to be robust, provided that the noise floor was set at a proper level. The digitization scheme was mainly driven by hardware constraints. To implement an analog to digital conversion scheme that linearly covers a 55 dB dynamic range would require a minimum of 17 bits. The general consensus was that 17 bits would be untenable for very large scale integration. Author (CISTI)

N92-20548*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
SYNTACTIC ERROR MODELING AND SCORING NORMALIZATION IN SPEECH RECOGNITION: ERROR MODELING AND SCORING NORMALIZATION IN THE SPEECH RECOGNITION TASK FOR ADULT LITERACY TRAINING Final Report
Lex Olorenshaw and David Trawick (Speech Systems, Inc., Tarzana, CA.) 30 Nov. 1991 41 p
(Contract NCC9-16; RICIS Proj. ET-28)
(NASA-CR-189938; NAS 1.26:189938) Avail: NTIS HC/MF A03 CSCL 17B

The purpose was to develop a speech recognition system to be able to detect speech which is pronounced incorrectly, given that the text of the spoken speech is known to the recognizer. Better mechanisms are provided for using speech recognition in a literacy tutor application. Using a combination of scoring normalization techniques and cheater-mode decoding, a reasonable acceptance/rejection threshold was provided. In continuous speech, the system was tested to be able to provide above 80 pct. correct acceptance of words, while correctly rejecting over 80 pct. of incorrectly pronounced words. Author

N92-20563*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
SYNTACTIC ERROR MODELING AND SCORING NORMALIZATION IN SPEECH RECOGNITION Interim Progress Reports, periods ending 30 Nov., 31 Jan. and 31 Mar. 1991
Lex Olorenshaw (Speech Systems, Inc., Tarzana, CA.) 31 Mar. 1991 23 p
(Contract NCC9-16; RICIS Proj. ET-28)
(NASA-CR-189944; NAS 1.26:189944) Avail: NTIS HC/MF A03 CSCL 17B

The objective was to develop the speech recognition system to be able to detect speech which is pronounced incorrectly, given that the text of the spoken speech is known to the recognizer. Research was performed in the following areas: (1) syntactic error modeling; (2) score normalization; and (3) phoneme error modeling. The study into the types of errors that a reader makes will provide the basis for creating tests which will approximate the use of the system in the real world. NASA-Johnson will develop this technology into a 'Literacy Tutor' in order to bring innovative concepts to the task of teaching adults to read. Author

N92-20653# Federal Aviation Administration, Atlantic City, NJ.
TELEVISION MICROWAVE LINK (TML) OPERATIONAL TEST AND EVALUATION (OT/E)/INTEGRATION TEST REPORT
Wayne E. Bell and Tuan A. Tran Mar. 1992 46 p
(DOT/FAA/CT-TN91/57) Avail: NTIS HC/MF A03

Given here are the results of the Operational Test and Evaluation (OT&E)/Integration test on the 15 GHz Television Microwave Link (TML) system. The TML is commercial off the shelf equipment. It provides the capability for air traffic control information to be relayed to a remote display from the Federal Aviation Administration (FAA) Digital Bright Radar Indicator Tower (DBRITE) system located at the terminal facility. The TML system was integrated and tested with the DBRITE system. Testing was successfully completed and met all of the T&E/Integration requirements. The acceptability of the remote DBRITE display was evaluated by the air traffic controllers and the data displayed on the remote DBRITE display provided the necessary information for air traffic control services. Therefore, the TML system is recommended for deployment. Author

N92-20672*# Pennsylvania State Univ., University Park. Dept. of Electrical and Computer Engineering.
A TWO-DIMENSIONAL TIME DOMAIN NEAR ZONE TO FAR ZONE TRANSFORMATION
Raymond J. Luebbers, Deirdre Ryan, John H. Beggs, and Karl S. Kunz May 1991 24 p
(Grant NAG1-1221)
(NASA-CR-190099; NAS 1.26:190099) Avail: NTIS HC/MF A03 CSCL 20N

A time domain transformation useful for extrapolating three dimensional near zone finite difference time domain (FDTD) results to the far zone was presented. Here, the corresponding two dimensional transform is outlined. While the three dimensional transformation produced a physically observable far zone time domain field, this is not convenient to do directly in two dimensions, since a convolution would be required. However, a representative two dimensional far zone time domain result can be obtained directly. This result can then be transformed to the frequency

domain using a Fast Fourier Transform, corrected with a simple multiplicative factor, and used, for example, to calculate the complex wideband scattering width of a target. If an actual time domain far zone result is required, it can be obtained by inverse Fourier transform of the final frequency domain result. Author

N92-20673*# Pennsylvania State Univ., University Park. Dept. of Electrical and Computer Engineering.
FINITE DIFFERENCE TIME DOMAIN IMPLEMENTATION OF SURFACE IMPEDANCE BOUNDARY CONDITIONS
John H. Beggs, Raymond J. Luebbers, Kane S. Yee (Lockheed Missiles and Space Co., Sunnyvale, CA.), and Karl S. Kunz Dec. 1991 30 p
(Grants NAG1-1350; NAG1-1332; NAG1-1221)
(NASA-CR-190103; NAS 1.26:190103) Avail: NTIS HC/MF A03 CSCL 20N

Surface impedance boundary conditions are employed to reduce the solution volume during the analysis of scattering from lossy dielectric objects. In the finite difference solution, they also can be utilized to avoid using small cells, made necessary by shorter wavelengths in conducting media throughout the solution volume. The standard approach is to approximate the surface impedance over a very small bandwidth by its value at the center frequency, and then use that result in the boundary condition. Here, two implementations of the surface impedance boundary condition are presented. One implementation is a constant surface impedance boundary condition and the other is a dispersive surface impedance boundary condition that is applicable over a very large frequency bandwidth and over a large range of conductivities. Frequency domain results are presented in one dimension for two conductivity values and are compared with exact results. Scattering width results from an infinite square cylinder are presented as a two dimensional demonstration. Extensions to three dimensions should be straightforward. Author

N92-20680*# Pennsylvania State Univ., University Park. Dept. of Electrical and Computer Engineering.
USER'S MANUAL FOR THREE DIMENSIONAL FDTD VERSION A CODE FOR SCATTERING FROM FREQUENCY-INDEPENDENT DIELECTRIC MATERIALS
John H. Beggs, Raymond J. Luebbers, and Karl S. Kunz Jan. 1992 22 p
(Grant NAG1-1221)
(NASA-CR-190102; NAS 1.26:190102) Avail: NTIS HC/MF A03 CSCL 20N

The Penn State Finite Difference Time Domain (FDTD) Electromagnetic Scattering Code Version A is a three dimensional numerical electromagnetic scattering code based on the Finite Difference Time Domain technique. The supplied version of the code is one version of our current three dimensional FDTD code set. The manual provides a description of the code and the corresponding results for the default scattering problem. The manual is organized into 14 sections: introduction, description of the FDTD method, operation, resource requirements, Version A code capabilities, a brief description of the default scattering geometry, a brief description of each subroutine, a description of the include file (COMMONA.FOR), a section briefly discussing radar cross section (RCS) computations, a section discussing the scattering results, a sample problem setup section, a new problem checklist, references, and figure titles. Author

N92-20687# Delaware Univ., Newark. Dept. of Mathematical Sciences.
THE INVERSE SCATTERING PROBLEM FOR ACOUSTIC AND ELECTROMAGNETIC WAVES Final Report, 1 Jan. 1989 - 31 Oct. 1991
David Colton and Peter Monk 31 Oct. 1991 6 p
(Grant AF-AFOSR-0284-89)
(AD-A244640; AFOSR-91-1019TR) Avail: NTIS HC/MF A02 CSCL 20/3

This project was concerned with the inverse scattering problem for time harmonic acoustic and electromagnetic waves. A new method has been developed to solve problems of this type based on the theory of Herglotz wave functions and nonlinear optimization methods. Preliminary numerical examples have been given for the case of both acoustic and electromagnetic waves. GRA

N92-20696# Naval Ocean Systems Center, San Diego, CA.
ADVANCED BEAMFORMING CONCEPTS: SOURCE LOCALIZATION USING THE BISPECTRUM, GABOR TRANSFORM, WIGNER-VILLLE DISTRIBUTION, AND NONSTATIONARY SIGNAL REPRESENTATION
J. C. Allen Dec. 1991 10 p Presented at the 25th Asilomar Comference on Signal, Systems and Computers, San Diego, CA, 4-6 Nov. 1991
(AD-A244884) Avail: NTIS HC/MF A02 CSCL 17/3

Power spectral estimation provides one approach to direction finding. This approach readily generalizes to produce a collection of newer direction finding algorithms. Estimation of the bispectrum yields a bispectral direction finder. Estimates of time-frequency distributions produce Wigner-Ville and Gabor direction-finders. Some types of non-stationary time series admit spectral estimators which can be used to localize a source. Chaotic signals can also be localized using recently developed parameter estimators. GRA

N92-20699# Environmental Research Inst. of Michigan, Ann Arbor.
STUDY OF THE MICROWAVE RESPONSE OF SEA ICE Final Report, May 1986 - Feb. 1991
Robert G. Onstott Dec. 1991 311 p
(Contract N00014-86-C-0469)
(AD-A244904; ERIM-196100-25-F) Avail: NTIS HC/MF A14 CSCL 17/9

This report documents work which has been performed to develop further the application of microwave science to geophysical property retrieval using satellite synthetic aperture radar (SAR). Efforts have included in-situ observations of the microwave properties of sea ice, the documentation of the physical properties which control backscatter intensity, the conduct of laboratory-based studies, the further development and utilization of electromagnetic models, the development of an empirical scattering responses, and the determinations of the sources of backscatter. Included is an executive summary of the research approach. Journal and proceeding papers are included to provide the summary of the results obtained. GRA

N92-20705# Arizona Univ., Tucson. Optical Sciences Center.
NONLINEAR GUIDED WAVES Final Report, 15 May 1988 - 30 Jun. 1991
E. M. Wright and G. I. Stegeman 19 Aug. 1991 8 p
(Contract DAAL03-88-K-0066)
(AD-A244728; ARO-25305.6-PH) Avail: NTIS HC/MF A02 CSCL 20/6

A number of guided wave effects related to nonlinear polariton phenomena have been investigated with particular attention on potential device applications. To summarize, the highlights were: (1) The theoretical prediction of the transfer of information between two adjacent waveguides using spatial solitons, the soliton coupler; (2) Previous work on soliton emission was extended to include the effects of absorption; (3) Prediction of solitary wave emission in 3D slab waveguide structures; (4) Prediction of spatial ring emission in 3D fiber waveguide geometry; (5) An effective particle theory was employed to understand the dynamics of highly nonlinear guided wave phenomena (this should prove useful in device design); (6) First general theory of nonlinear guided wave phenomena in semiconductors, and its application to nonlinear directional couplers; (7) Predictions of instabilities of coupled solitons propagating in nonlinear fiber couplers. The applications of these ideas to wavelength dependent soliton de-multiplexing was also explored. GRA

N92-20796# Manchester Univ. (England). Dept. of Electrical Engineering and Electronics.
FINITE ELEMENT ANALYSIS OF WAVEGUIDES M.S. Thesis

D. A. W. Wilson Oct. 1990 148 p
(ETN-92-90658) Copyright Avail: NTIS HC/MF A07

Various computer resources allowing numerical techniques to be applied in the field of electromagnetics are described. The finite element numerical technique is investigated in detail. Two methods of forming functionals are enunciated. The first is the classic approach involving the construction of a quadratic functional from the wave equation. The second demonstrates how the functional can be determined through complex power flow considerations. Software is developed and used to make calculations on simple waveguides. ESA

N92-20847# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
COMPENSATING FOR GROUNDPLANE DEFORMATIONS OF A SPACE-BASED RADAR TO IMPROVE CLUTTER CANCELLATION PERFORMANCE
George H. Emmons 5 Nov. 1991 67 p
(Contract F19628-90-C-0002)
(AD-A244783; TR-931; ESD-TR-91-110) Avail: NTIS HC/MF A04 CSCL 17/9

Effects of deformations on the clutter cancellation of a hypothetical large phased-array space-based radar antenna groundplane are described. The radar is assumed to use a displaced-phase-center antenna (DPCA) for cancelling stationary ground clutter. A multilateration method of measuring the deformations is analyzed to determine its effectiveness in compensating for the deformations and improving clutter cancellation. Finally, a data staleness problem inherent in the proposed serial sampling method is described, a potential solution is presented, and its feasibility is discussed. Author (GRA)

N92-20871# Environmental Research Inst. of Michigan, Ann Arbor.
MODULATION TRANSFER FUNCTION ANALYSIS OF KELVIN WAKES AND AMBIENT WAVE IMAGES Technical Report, 1 Oct. 1990 - 30 Sep. 1991
D. Lyzenga, N. Malinas, and J. Burns Sep. 1991 98 p
(Contract N00014-88-C-0355)
(AD-A244995; ERIM-207500-7-T) Avail: NTIS HC/MF A05 CSCL 17/9

Synthetic aperture radar (SAR) images collected during a 1989 surface ship wake experiment are analyzed using a linear imaging model which includes contributions due to velocity bunching, tilt modulation and hydrodynamic modulation as well as azimuth falloff and coherent speckle effects. This model adequately predicts the overall shape of the image spectrum for ambient waves as observed from three different look directions, although there are some discrepancies for range-traveling waves which are attributed to uncertainties in the tilt and hydrodynamic modulation. Inversion of the model to yield estimates of the Kelvin wake and ambient wave heights appears to be successful, although the results are sensitive to the value assumed for the surface decorrelation time. GRA

N92-20876# Applied Silicon, Inc., Ottawa (Ontario).
DOPPLER RADAR DATA ACQUISITION SYSTEM: REQUIREMENT SPECIFICATION AND FEASIBILITY STUDY
Dan Sharon Jun. 1990 38 p Sponsored by Defence Research Establishment
(CTN-92-60419) Avail: NTIS HC/MF A03

This report discusses the requirements and design specifications of a data acquisitions system (DAS) designed to record airborne pulse Doppler radar signals. The bulk of the data will consist of four channels of high-speed analog radar signals including an in-phase channel, a quadrature channel each for a main, and a guard channel. The system will be required to digitilize the four channels of analog signals at 1 MHz each, and record the data at a sustained rate of 2 MBytes/sec for a total of 10 minutes of recording time. The DAS must also record aircraft dynamic parameters (ground speed, altitude, roll, yaw, pitch, and global navigation system position and heading) and radar parameters (pulse repetition frequency, burst length, pulse width, and center frequency). In this report, system requirements for data handling, the radar transceiver, the aircraft guidance system, a high speed data acquisitions system, a dedicated embedded controller, and one or more mass storage devices and their interfaces are evaluated. Recommendations are made for solutions based on analysis of factors such as performance, cost, development effort, and the availability of off-the-shelf components that meet the required specifications. Feasibility system configuration options are presented along with itemized costs associated with implementing each option. CISTI

N92-20897# Calspan Corp., Arnold AFS, TN.
CALIBRATION OF AN AEDC LOW-TEMPERATURE BLACKBODY STANDARD AT NIST Final Report, Feb. 1990 - Jun. 1991
K. B. Jarratt Jan. 1992 24 p Prepared for AEDC, Arnold Air Force Station, TN
(AD-A245071; AEDC-TR-91-9) Avail: NTIS HC/MF A03 CSCL 17/5

Sensors and their focal planes that are responsive to long-wavelength infrared (LWIR) energy and operate in a low-pressure environment require calibration. Calibration is normally accomplished in a vacuum chamber having an optically tight, cryogenically cooled liner. A blackbody source or attenuated blackbody source is used in the chamber to provide a known level of LWIR energy to the sensor or focal plane. Prior to the test, these blackbodies must also be calibrated. In late 1989, the National Institute of Standards and Technology (NIST), began operation of their Low Background Infrared (LBIR) Calibration Facility. AEDC was the second customer at the new facility and obtained a calibration of a 400 K, multiple aperture source in February 1990. The final calibration report was received from NIST in February 1991. GRA

N92-20962# Lawrence Livermore National Lab., CA.
COHERENCE IN STRONG FIELD HARMONIC GENERATION
A. LHuillier, P. Balcou (Commissariat a l'Energie Atomique, Gif-sur-Yvette, France), K. J. Schafer, and K. C. Kulander Oct. 1991 14 p Presented at the North Atlantic Treaty Organization (NATO) Advanced Research Workshop on Coherence in the Interaction of Radiation with Atoms, Ontario (Canada), 3-11 May 1991
(Contract W-7405-eng-48)
(DE92-007351; UCRL-JC-108685; CONF-9105204-2) Avail: NTIS HC/MF A03

In this paper we discuss recent studies of harmonic generation in rare gases, including our current understanding of the special circumstances in the intense field regime which result in the observation of very strong high-order harmonics. The combination of a non-perturbative atomic response and enhanced phase matching in the medium is responsible for the high conversion efficiencies. The calculations point to those attributes of the microscopic atomic emission rates which yield the strong macroscopic, coherent harmonic output. We begin with a simple model of a one-dimensional electron in a strong oscillating field to provide some insight into the source of the single-atom emission spectrum. Next, we present a brief description of our calculations for realistic atoms. A review of recent experimental results is followed by a discussion of the method used for calculating the effects of phase matching on the emitted radiation. In the final section we discuss the agreement between the experimental and theoretical results, and describe the important differences between traditional, perturbative harmonic generation and that found in this new, non-perturbative, strong field regime. DOE

N92-20965# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
RELATIONSHIPS BETWEEN AVERAGE RADAR POWER AND STEADY-STATE TRACK ACCURACY
William H. Gilson 27 Nov. 1991 50 p
(Contract F19628-90-C-0002)
(AD-A245032; MIT-TR-932; ESD-TR-91-112) Avail: NTIS HC/MF A03 CSCL 17/9

This report describes a methodology used for relating resources consumed by tracking a maneuvering target to the track accuracy achieved. The methodology accounts for beam shape loss, missed detections, and, in the case of a fire control radar, reacquisition of the target when it has moved outside the beam. This report presents normalized computational results for the minimum radar power required as a function of the track accuracy, along with the optimal revisit frequencies and the signal-to-noise ratios. GRA

N92-20978# SRI International Corp., Menlo Park, CA.
ALGORITHMS FOR RADIO NETWORKS WITH DYNAMIC TOPOLOGY Final Report, 15 May 1988 - 14 May 1991
Nachum Shacham, Richard Ogier, Vladislav V. Rutenburg, and Jose Garcia-Luna-Aceves Aug. 1991 31 p
(Contract DAAL03-88-K-0054)
(AD-A244477; ITAD-6229-FR-91-103; ARO-24912.10-EL) Avail: NTIS HC/MF A03 CSCL 25/2

The objective of this project was the development of advanced algorithms and protocols that efficiently use network resources to provide optimal or nearly optimal performance in future communication networks with highly dynamic topologies and subject to frequent link failures. As reflected by this report, we have achieved our objective and have significantly advanced the state-of-the-art in this area. The research topics of the papers summarized include the following: efficient distributed algorithms for computing shortest pairs of disjoint paths; minimum-expected-delay alternate routing algorithms for highly dynamic unreliable networks; algorithms for loop-free routing; multipoint communication by hierarchically encoded data; efficient algorithms for extracting the maximum information from event-driven topology updates; methods for the neural network solution of link scheduling and other difficult problems arising in communication networks; and methods for robust routing in networks subject to sophisticated attacks. GRA

N92-20980# Delta Information Systems, Inc., Horsham, PA.
TEMPORAL FREQUENCY AS A TECHNIQUE TO MEASURE THE ABILITY OF A TELECONFERENCING SYSTEM TO REPRODUCE MOTION Final Report
Jan. 1991 40 p
(Contract DCA100-87-C-0078)
(AD-A244513; NCS-TIB-91-2) Avail: NTIS HC/MF A03 CSCL 25/5

This report covers investigations and measurements of temporal frequency responses as a means to numerically analyze the motion performance capability of a digital video teleconferencing codec. The effort described in this report contains a more detailed analysis, refinement of measuring techniques and a large selection of measured values of temporal frequency responses and other related performance parameters on three different codec models. It reviews the parameters which can be observed in the picture. It covers the development of the test procedure and reviews the test signals and describes the methodology of their applications. It contains a discussion of the test results and shows them to be fully logical and in accordance with expectation and limited observations. It also gives a brief review of the program and contains recommendations to further efforts in the objective performance evaluation of digital video codecs. Author (GRA)

N92-20981# Naval Ocean Systems Center, San Diego, CA.
SPATIAL SMOOTHING OF IONOSPHERIC PARAMETERS FOR USE IN THE HIGH-FREQUENCY BENCHMARK PROPAGATION ANALYSIS PROGRAM
J. A. Ferguson and C. H. Shellman Nov. 1991 18 p
(AD-A244532; NOSC-TR-1469) Avail: NTIS HC/MF A03 CSCL 20/14

This report describes a computer program for the spatial smoothing of ionospheric parameters for use in the High-Frequency (HF) Benchmark Propagation Analysis Program. The HF Benchmark, being developed at the Naval Ocean Systems Center (NOSC), employs a sophisticated ray tracing program coupled with a state-of-the-art ionospheric model. The merging of these two major components depends critically on the development of a spatial smoothing routine that accepts arbitrary ionospheric models as input. GRA

N92-21017# Naval Postgraduate School, Monterey, CA.
PERFORMANCE OF FAST FREQUENCY-HOPPED NONCOHERENT MFSK CONVENTIONAL AND SELF-NORMALIZATION RECEIVERS OVER RICIAN- AND RAYLEIGH-FADED CHANNEL WITH PARTIAL-BAND INTERFERENCE M.S. Thesis
Kang Y. Lee Sep. 1991 89 p
(AD-A245065) Avail: NTIS HC/MF A05 CSCL 12/9

An error probability analysis is performed for an M-ARY orthogonal frequency shift keying (MFSK) receiver employing fast frequency-hopped (FH) spread spectrum waveforms transmitted over a fading channel with partial-band interference. The partial-band interference is modeled as a Gaussian process. Wideband thermal noise is also included in the analysis. Diversity is performed using hops per data bit. Each diversity reception is assumed to fade independently according to a nonselective Rician process. A nonlinear combination procedure, referred to as self-normalization combining, is employed by the receiver to minimize partial-band interference effects. Author (GRA)

N92-21020# Michigan Univ., Ann Arbor. Radiation Lab.
MILLIMETER-WAVE MEASUREMENTS AND MODELLING OF THE SCATTERING PHASE FUNCTION OF INHOMOGENEOUS MEDIA Final Report, 1 Sep. 1990 - 20 Apr. 1991
Fawwaz T. Ulaby 1 Jul. 1991 11 p
(Contract DAAL03-90-G-0203)
(AD-A244494; ARO-28358.1-GS-EQ) Avail: NTIS HC/MF A03 CSCL 20/14

ARO Contract DAAL-03-90-G-0203 provided funds for the purchase of equipment to upgrade the University of Michigan's Millimeter-Wave Radar Systems. The 35 and 94 GHz channels were modified to operate in two modes: (1) totally coherent polarimetric mode; and (2) coherent-on-receive polarimetric mode. The totally coherent mode is used for laboratory measurements to obtain the complete scattering matrix of the object of interest. The coherent-on-receive mode is used under field conditions to measure the Mueller matrix and degree of polarization in situ. Experiments were conducted to verify that both modes provide identical results under laboratory conditions. GRA

N92-21022# Range Commanders Council, White Sands Missile Range, NM.
FREQUENCY STANDARDS FOR RADAR TRANSPONDERS
Dec. 1991 6 p Supersedes FCWG-250-65; N77-77690
(AD-A244499; RCC-250-91; FCWG-250-65) Avail: NTIS HC/MF A02 CSCL 05/1

This document defines the selection and use of the frequencies available for instrumentation radar transponders. The information regarding frequency assignments was extracted from the National Telecommunications and Information Administration's Manual of Regulations and Procedures for Federal Frequency Management, Chapter 4, May 1989 edition. Author (GRA)

N92-21047# Oak Ridge National Lab., TN.
EXPERIMENTAL DETERMINATION OF THE MHD-EMP EFFECTS ON POWER DISTRIBUTION TRANSFORMERS
B. W. McConnell, Paul R. Barnes, and Frederick M. Tesche (Tesche, Frederick M., Dallas, TX) 1991 6 p Presented at the 1992 Hardened Electronics and Radiation Technology (HEART) Conference, Albuquerque, NM, 24-28 Feb. 1992
(Contract DE-AC05-84OR-21400)
(DE92-003556; CONF-920223-3) Avail: NTIS HC/MF A02

It is a well-established fact that geomagnetic storms influence electrical power transmission and distribution systems. Previous cases of such storms in the northern latitudes have resulted in occasional power disruptions, and in some cases, damage to transformers. These effects are caused by a time variation of the earth's magnetic field creating an induced electric field along the surface of the earth. This E-field acts as a voltage source along

long power transmission or distribution lines, and if the line is connected to the earth at both ends, a quasi-dc current can flow. This current can cause unwanted saturation in the magnetic cores of transformers in the power system, and this, in turn produces harmonic distortion and transformer heating. This can lead to system upset (shutdown) and possibly transformer burn-out. The detonation of a high altitude nuclear explosion is also known to affect the magnetosphere, producing late-time variations of the earth's magnetic field for several hundreds of seconds. Known as the magnetohydrodynamic electromagnetic pulse (MHD-EMP), or E(sub 3), this environment is of particular concern to electrical power systems in the event of a nuclear attack. Although the MHD-EMP induced currents can be significantly larger in magnitude, they last for a shorter period of time than do those from a geomagnetic storm. The effect of this environment compounds the adverse effects of the early-time high altitude EMP (HEMP) environment, posing a potentially serious threat to the electrical system. The present paper documents an experimental program designed to better understand the behavior of distribution-class transformers subjected to quasi-dc current excitation. Given the knowledge of the MHD-EMP-induced current flowing in a long power line, and the transformer response characteristics obtained in this program, it will be possible to make more accurate assessments of the behavior of the overall power system to EMP. DOE

33 ELECTRONICS AND ELECTRICAL ENGINEERING

Includes test equipment and maintainability; components, e.g., tunnel diodes and transistors; microminiaturization; and integrated circuitry.

For related information see also *60 Computer Operations and Hardware* and *76 Solid-State Physics*.

N92-20048# Lawrence Livermore National Lab., CA.
HIGH-POWER MICROWAVE BANDWIDTH BROADENING BY AIR BREAKDOWN
D. J. Mayhall, J. H. Yee, and R. A. Alvarez Dec. 1991 16 p Presented at the Ultrawideband Radar, SPIE Laser, and Radar Engineer Symposium, Los Angeles, CA, 19-24 Jan. 1992
(Contract W-7405-eng-48)
(DE92-005246; UCRL-JC-107442; CONF-920124-5) Avail: NTIS HC/MF A03

Wideband, high-power microwave pulses are expected to have important applications in ultra-wideband radar. The wide bandwidth should generate increased information for target characterization and identification. The high power should result in increased target detection range for conventional targets and targets with reduced signatures. A way to generate wideband, high-power microwave pulses with relatively conventional technology is to tail erode high-power pulses by passage through a low pressure air cell. In this process, the tails of short (3 to 10 ns), high amplitude (greater than 1 MV/m) pulses are removed. This erosion shortens the pulses and generates transmitted pulses with broadened bandwidths. The pressure must be matched to several incident pulse characteristics to create enough electron density to cause strong tail erosion. The important pulse characteristics are amplitude, frequency, pulse length, and pulse shape. We have shown experimentally that tail erosion from air breakdown broadens the 3 dB bandwidths of 2.8608 GHz incident pulses in a rectangular waveguide at 3.5 torr. The incident pulse amplitude varied from 0.67 to 1.16 MV/m. The pulse bandwidth increased from 0.147 GHz by 0.34 to 1.4 pct. relative. The incident bandwidth was 5.12 pct. relative to the incident carrier frequency. This experimental broadening was simulated with a 2D, electromagnetic, electron fluid computer code for avalanche ionization. The simulation predicted bandwidth broadening by 0.029 to 0.13 GHz or 1.0 to 4.4 pct. relative for a peak initial electron density of 10 electrons/cu cm. Although the measured and calculated transmitted electric field envelopes were in close agreement, the calculated bandwidths exceeded those measured by 13 to 47 pct. Because the detectors were not fast enough to resolve individual cycles we presently conclude that the simulation gives better estimates of reality than do the measurements. DOE

N92-20079# Columbia Univ., New York, NY. Dept. of Electrical Engineering.
PSEUDOMORPHIC NARROW GAP MATERIALS FOR HIGH PERFORMANCE DEVICES Annual Technical Report, 15 Dec. 1990 - 14 Dec. 1991
Wen I. Wang 18 Oct. 1991 9 p
(Contract N00014-90-J-1536)
(AD-A243148) Avail: NTIS HC/MF A02 CSCL 09/1

Indium Arsenide field effect transistors (1 micron gate lengths) have been fabricated and showed extrinsic (intrinsic) transconductance as high as 414 mS/mm (670mS/mm). The cut-off frequency is estimated to be more than a factor of two greater than is typical for GaAs based FET's with comparable gate length. The FET has also been operated at electric fields greater than 20 kV/cm without any indication of breakdown, far above the bulk breakdown value of 6 kV/cm. Several mechanisms have been proposed to explain this phenomenon. The threshold current densities of separate confinement strained AlGaAs/GaAs/InGaAs lasers have been shown to be insensitive to the quality of the Aluminum Gallium Arsenide outer cladding layers due to the use of a thick GaAs inner cladding layer. We have also shown theoretically that (1) infrared absorption at normal incidence due to intervalence subband transition can be greatly enhanced in light-hole and heavy-hole inverted strained GaInAs/AlInAs quantum wells, and (2) with biaxial tensile strain, exciton absorption and saturation limit in quantum wells can be enhanced.
Author (GRA)

N92-20129# Sandia National Labs., Albuquerque, NM.
AN EXPERIMENTAL/ANALYTICAL STUDY OF STRAINS IN ENCAPSULATED ASSEMBLIES
T. R. Guess and S. N. Burchett 1991 20 p Presented at the ASME/Japan Society of Mechanical Engineers Joint Conference on Electronic Packaging, San Jose, CA, 9-12 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-003576; SAND-91-1748C; CONF-920452-1) Avail: NTIS HC/MF A03

A combined experimental and analytical study of strains that develop in encapsulated assemblies during casting, curing and thermal excursions is described. The experimental setup, designed to measure in situ strains, consisted of thin, closed-end, metal tubes that were instrumented with strain gages and thermocouples before being over-potted with an encapsulant. Three epoxy-based materials were studied. After cure of the encapsulant, tube strains were measured over the temperature range of minus 55 C to 90 C. The thermal excursion experiments were then numerically modeled using finite element analyses and the results were compared to the experimental results. The predicted strains are overestimated (conservative) when a linear, elastic, temperature-dependent material model was assumed for the encapsulant and the stress free temperature was assumed to correspond to the cure temperature of the encapsulant. Very good agreement was obtained with the linear elastic calculations provided that the stress free temperature corresponds to the onset of the glassy-to-rubbery transition range of the encapsulant. Finally, very good agreement was obtained when a viscoelastic material model was utilized and a stress free temperature corresponding to the cure temperature was assumed. DOE

N92-20140# Ames Lab., IA.
AN EFFICIENCY STUDY OF PVDF FILM TRANSDUCERS AND THEIR WAVEFORM MODELING IN CYLINDRICAL GEOMETRY Ph.D. Thesis
Zhong Zhang 20 Dec. 1991 104 p
(Contract W-7405-eng-82)
(DE92-005155; IS-T-1611) Avail: NTIS HC/MF A06

In this thesis, the efficiency formulas for a transducer working as a transmitter or a receiver was derived directively from the piezoelectric constitutive equation. The transducer efficiency in a

pulse-echo measurement was also given by multiplying the efficiencies for the transmitter and the receiver. The comparison between the PVDF (polyvinylidene fluoride) film transducer and the conventional PZT ceramic transducers was made based on the efficiency formulas. Based on the impulse response approach, an analytical model was built to predict the pulse waveform for through-transmission and pulse-echo measurements when the film transducer was applied in geometry. The experiments were also made to observe echo waveforms in cylindrical rod samples. The same approach was also expanded to evaluate the echo waveforms from artificial flaws inside the cylindrical rod. The model prediction and the experimental results were in reasonably good agreement. DOE

N92-20142# Sandia National Labs., Albuquerque, NM.
A CURE SHRINKAGE MODEL FOR ANALYZING THE STRESSES AND STRAINS IN ENCAPSULATED ASSEMBLIES
R. S. Chambers, R. R. Lagasse, T. R. Guess, D. J. Plazek, and C. Bero (Pittsburgh Univ., PA.) 1992 12 p Presented at the ASME/Japan Society of Mechanical Engineers Joint Conference on Electronic Packaging, San Jose, CA, 9-12 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-002926; SAND-91-1829C; CONF-920452-2) Avail: NTIS HC/MF A03

Electrical component assemblies are encapsulated to provide delicate parts with voltage isolation and protection against damage caused by shock, vibration, and harsh atmospheric environments. During cure, thermosetting resins shrink and harden simultaneously. If the natural deformation of the resin is constrained by adhesion to the mold or to relatively stiff embedded components, cure shrinkage stresses are generated in the encapsulant. Subsequent cooling or thermal cycling produces additional stresses that are caused by the mismatches in thermal strains among the materials in the encapsulated assembly. Although cure shrinkage stresses frequently are neglected because they are considerably smaller than thermal stresses, cure shrinkage stresses can cause delamination or fractures in the encapsulant, since the partially cured resin is not as tough as the fully cured material. Cracks generated during cure can compromise performance (e.g., permit dielectric breakdown), degrade a component's protection, and grow under subsequent thermal cycling producing residual stresses that differ from those found in uncracked assemblies. DOE

N92-20287# Environmental Protection Agency, Ann Arbor, MI. Control Technology and Applications Branch.
EVALUATION OF A SCHATZ HEAT BATTERY ON A FLEXIBLE-FUELED VEHICLE
Gregory K. Piotrowski and Ronald M. Schaefer Sep. 1991 31 p
(PB92-114255; EPA/AA/CTAB-91/05) Avail: NTIS HC/MF A03 CSCL 09C

The evaluation is described of a Schatz Heat Battery as a means of reducing cold start emissions from a motor vehicle fueled with both gasoline and M85 high methanol blend fuel. The evaluation was conducted at both 20 and 75 F ambient temperatures. The test vehicle was a flexible fueled 1990 Audi 80 supplied by Volkswagen of America. A description is included of the test vehicle, the test facilities, the analytical methods and test procedures used. Author

N92-20348# General Atomic Co., San Diego, CA.
GLOW DISCHARGE INITIATION WITH ELECTRON GUN ASSIST
K. L. Holtrop, G. L. Jackson, K. M. Schaubel, and A. G. Kellman Nov. 1991 4 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contract DE-AC03-89ER-51114)
(DE92-005437; GA-A-20617; CONF-910968-55) Avail: NTIS HC/MF A01

Helium glow discharge conditioning is used before every discharge in the D3-D Tokamak to desorb hydrogen and low Z impurities from the graphite and Inconel plasma facing surfaces. However high gas pressure is required to initiate each glow discharge session and this requires frequent cycling of valves to protect pressure sensitive devices. To alleviate this mechanical fatigue an electron gun assisted glow system (EAG) is being installed on the D3-D vessel to lower the initiation pressure. Through the injection of electrons the initiation pressure of the helium glow discharge has been lowered by a factor of 70, bringing the initiation pressure within a factor of 2 of the minimum sustaining pressure of the glow discharge. This might also make possible pulsed glow conditioning which would allow a lower average pressure during glow conditioning reducing the heat load on proposed cryogenic pumping panels. Experimental results of the electron assist on He glow initiation and a scaling model for the electron gun assisted glow will be presented. The electron gun can also be used as a diagnostic. Without a glow discharge, the electron gun has been pulsed into the wall and desorbed gas measured by a Residual Gas Analyzer. We are attempting to correlate the desorbed gas with recycling or vessel cleanliness. DOE

N92-20371*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
BUGS SYSTEM CLOCK DISTRIBUTOR
Thomas M. Dietrich Nov. 1991 16 p
(NASA-TM-103569; NAS 1.15:103569) Avail: NTIS HC/MF A03 CSCL 09C

A printed circuit board which will provide external clocks and precisely measure the time at which events take place was designed for the Bristol University Gas Spectrometer (BUGS). The board, which was designed to interface both mechanically and electrically to the Computer Automated Measurement and Control (CAMAC) system, has been named the BUGS system clock control. The board's design and use are described. Author

N92-20407# Brookhaven National Lab., Upton, NY.
MONOLITHIC JUNCTION FIELD-EFFECT TRANSISTOR CHARGE PREAMPLIFIER FOR CALORIMETRY AT HIGH LUMINOSITY HADRON COLLIDERS
V. Radeka, S. Rescia, L. A. Rehn, P. F. Manfredi, and V. Speziali (Pavia Univ., Italy) Nov. 1991 6 p Presented at the IEEE Nuclear Science Symposium, Santa Fe, NM, 5-9 Nov. 1991
(Contract DE-AC02-76CH-00016)
(DE92-007185; BNL-46209; CONF-911106-69) Avail: NTIS HC/MF A02

The outstanding noise and radiation hardness characteristics of epitaxial-channel junction field-effect transistors (JFET) suggest that a monolithic preamplifier based upon JFET technology may be able to meet the strict specifications for calorimetry at high luminosity colliders. Results obtained to this point, using a buried layer planar technology, among them an entire monolithic charge-sensitive preamplifier, are described. DOE

N92-20447# National Inst. of Standards and Technology, Boulder, CO. Materials Reliability Div.
OXIDES AND OXIDE SUPERCONDUCTORS: ELASTIC AND RELATED PROPERTIES
M. Lei and H. Ledbetter Aug. 1991 100 p
(PB92-112333; NISTIR-3980) Avail: NTIS HC/MF A05 CSCL 09A

Using both measurements and modeling, the elastic and related properties of some oxides and oxide superconductors were studied. The polycrystal elastic constants were measured using a MHz frequency pulse echo method between 295 and 4 K and corrected to the void-free state by using a model for a composite material containing spherical particles. The elastic moduli of the high T(c) superconductor Y1Ba2Cu3O7 (YBCO) were compared with that of oxides, especially the perovskites, BaTiO3 and SrTiO3, which are crystal structure building blocks for the YBCO superconductor. The bulk moduli were also calculated using a Born ionic model with two energy terms: electrostatic (Madelung) and ion core repulsion. The calculated bulk modulus of YBCO, 98 GPa, agrees well with measurement, 101 GPa. Based on monocrystal measurements combined with analysis theory, elastic stiffnesses C(ij) for orthorhombic YBCO were estimated. The bulk modulus

obtained from the estimated C(ij) by the Voigt-Reuss-Hill averaging method agrees well with the monocrystal measurement. From the measured polycrystalline elastic constants, the Debye characteristic temperatures were calculated. Author

N92-20449# National Inst. of Standards and Technology, Boulder, CO. Electromagnetic Technology Div.
HIGH-TEMPERATURE SUPERCONDUCTIVITY: ABSTRACTS OF NIST PUBLICATIONS, 1987 - 1991 Final Report
M. E. DeWeese Nov. 1991 93 p
(PB92-126564; NIST/SP-826) Avail: NTIS HC/MF A05; also available SOD HC $5.00 as 003-003-03128-3 CSCL 09C

The report is a collection of abstracts from 243 papers published between March 1987 and August 1991 covering various aspects of superconductivity research. The work of nine divisions of the National Institute of Standards and Technology (formerly the National Bureau of Standards) in both Boulder, Colorado, and Gaithersburg, Maryland, is represented. GRA

N92-20492*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
TIME-FREQUENCY REPRESENTATION OF A HIGHLY NONSTATIONARY SIGNAL VIA THE MODIFIED WIGNER DISTRIBUTION
T. F. Zoladz, J. H. Jones, and J. Jong (Wyle Labs., Inc., Huntsville, AL.) Washington Mar. 1992 35 p
(NASA-TP-3215; M-685; NAS 1.60:3215) Avail: NTIS HC/MF A03 CSCL 09C

A new signal analysis technique called the modified Wigner distribution (MWD) is presented. The new signal processing tool has been very successful in determining time frequency representations of highly non-stationary multicomponent signals in both simulations and trials involving actual Space Shuttle Main Engine (SSME) high frequency data. The MWD departs from the classic Wigner distribution (WD) in that it effectively eliminates the cross coupling among positive frequency components in a multiple component signal. This attribute of the MWD, which prevents the generation of 'phantom' spectral peaks, will undoubtedly increase the utility of the WD for real world signal analysis applications which more often than not involve multicomponent signals. Author

N92-20506# Tuebingen Univ. (Germany, F.R.). Fakultaet fuer Physik.
APPLICATION ORIENTED OPTIMIZATION OF MICROCHANNEL PLATE CONFIGURATION FOR OPEN PAUSE NUMBER DETECTORS Ph.D. Thesis [AWENDUNGSORIENTIERTE OPTIMIERUNG DER MIKROKANALPLATTEN-ANORDNUNG FUER OFFENE PULSZAEHLENDE DETEKTOREN]
Johannes Maria Riegger 1990 132 p In GERMAN Sponsored by BMFT
(ETN-92-90636) Avail: NTIS HC/MF A07

The resolution power was determined for a read out device with wedge and strip anodes by a new offset term. A new way was opened for an optimization of detector characteristics and its stability, and the simultaneous minimization of the background, by examining different Z configurations of microchannel plates in operation with opposing and accelerating fields. It is shown how image interfering by an after glow minimizes insufficient microchannel plates, and how a safer and more stable operation of the detector can be obtained with optimal performance data. ESA

N92-20555# Sandia National Labs., Albuquerque, NM.
LOW-INDUCTANCE PULSE-DISCHARGE CAPACITOR STUDY
L. R. Edwards 1992 6 p Presented at the 12th Capacitor and Resistor Technology Symposium, Tucson, AZ, 16-19 Mar. 1992
(Contract DE-AC04-76DP-00789)
(DE92-004894; SAND-91-1991C; CONF-920372-1) Avail: NTIS HC/MF A02

The Capacitors Division at Sandia National Laboratories has for many years been actively involved in developing high reliability, low inductance, energy storage, pulse discharge capacitors. Development has concentrated on two dielectric systems; mica-paper and Mylar (both dry wrap and fill and FC40 liquid impregnation). Continuous design improvements are constantly being sought. For pulse discharge usage lowering the capacitor inductance can improve circuit performance. This paper describes recent efforts to improve the efficiency of low inductance, mica-paper capacitors by reducing the inductance through optimizing the component geometry. The study focused on a 0.2 micro-F, 4000 V mica-paper extended-foil capacitor design. The experimental matrix was a two-level, three factor with center points design, and was replicated four times to give reasonable statistics. The factors were the capacitor width, capacitor length, and electrode width, and with response functions of capacitor inductance and circuit performance. The capacitor inductance was measured by the resonance technique, and the circuit performance was evaluated by peak (discharge) current and rise time. Results show that the inductance can be minimized by choice of geometry with accompanying improvements in circuit performance. DOE

N92-20640# International Trade Administration, Washington, DC.
ELECTRIC CURRENT ABROAD, 1991 EDITION
Jul. 1991 95 p
(PB91-193383) Avail: NTIS HC/MF A05; also available SOD HC $3.00 as 003-008-00203-0 CSCL 09C

The characteristics are listed, for the information of U.S. manufacturers and exporters and individuals living or traveling abroad, of electric current available and the type of attachment plugs used in principal cities throughout the world. The characteristics of electric current-type (alternating or direct current), number of phases, frequency (hertz), and voltage found in major foreign cities are listed. In addition, the stability of the frequency and the number of wires to a commercial or residential installation are given where available. The current characteristics and other data furnished relate to domestic and commercial service only. It does not include special commercial installations involving relatively high voltage requirements nor does it refer to any industrial installations. Author

N92-20682# Phillips Lab., Kirkland AFB, NM.
LiTaO3 AND LiNbO3:Ti RESPONSES TO IONIZING RADIATION Final Report, 11 Jan. 1989 - 30 Apr. 1991
R. J. Padden, E. W. Taylor, A. D. Sanchez, J. N. Berry, and S. P. Chapman Nov. 1991 24 p
(AD-A244459; AD-E200802; PL-TN-91-1067) Avail: NTIS HC/MF A03 CSCL 18/7

Optical guided wave devices can experience crosstalk and mode-switching in the presence of ionizing radiation. This technical note discusses the responses of LiTaO3 and LiNbO3:Ti directional coupler waveguides to exposures of linearly accelerated electrons. A comparison of the waveguides in terms of sensitivity to the ionizing radiation is made. GRA

N92-20689# . Naval Ocean Systems Center, San Diego, CA.
INTEGRATED AUTOMATION FOR MANUFACTURING OF ELECTRONIC ASSEMBLIES
T. J. Sampite Dec. 1991 10 p
(AD-A244890) Avail: NTIS HC/MF A02 CSCL 09/1

Since 1985, the Naval Ocean Systems Center has been identifying and developing needed technology for flexible manufacturing of hybrid microelectronic assemblies. Specific projects have been accomplished through contracts with manufacturing companies, equipment suppliers, and joint efforts with other government agencies. The resulting technology has been shared through semi-annual meetings with government, industry, and academic representatives who form an ad hoc advisory panel. More than 70 major technical capabilities have been identified for which new development is needed. Several of these developments have been completed and are being shared with industry. Author (GRA)

N92-20690# Naval Postgraduate School, Monterey, CA.
A VLSI DESIGN OF A RADIX-4 FLOATING POINT FFT BUTTERFLY M.S. Thesis
Michael L. Zimmer Dec. 1991 126 p
(AD-A245080) Avail: NTIS HC/MF A07 CSCL 12/6

Cyclic Spectrum Analysis is used to exploit the cyclostationary properties of signals and systems. Implementing such a system will require high speed arithmetic processing. Investigations into high speed arithmetic and FFT design are conducted. Integrated circuits of a 45 MHz floating point multiplier, adder, and rate-1/4 radix-4 FFT butterfly, implemented with a 20-bit word size, are presented using the Genesil Silicon Compiler. GRA

N92-20693# Massachusetts Inst. of Tech., Cambridge.
STUDY OF MICROSTRIP ANTENNAS FOR WIDEBAND AND MULTIPOLARIZATION APPLICATIONS Final Report, Mar. 1988 - Aug. 1990
S. M. Ali Nov. 1991 44 p
(Contract F19628-88-K-0013)
(AD-A245101; RL-TR-91-313) Avail: NTIS HC/MF A03 CSCL 09/1

The purpose of this research project is to analyze the properties of microstrip antennas in multilayered anisotropic material for wideband multipolarization applications. The following problems are considered to be of major importance: (1) the development of the dyadic Green's function formulation; (2) the excitation of modes of multilayered microstrip antennas; (3) electromagnetically coupled microstrips in multilayer anisotropic media; and (4) multi-element multi-resonance structures. Whereas the dyadic Green's function in conjunction with the method of moments provides a unified approach to all the problems, the vector transform technique can be used to solve problems with symmetry. The mode analysis on the dyadic Green's function will provide physical insight in finding a suitable design. GRA

N92-20714# Honeywell, Inc., Bloomington, MN. Sensor and System Development Center.
RF VACUUM MICROELECTRONICS Quarterly Technical Report, 1 Oct. - 31 Dec. 1991
T. Akinwande, P. Bauhahn, T. Ohnstein, J. Holmen, and D. Arch 15 Jan. 1992 8 p
(Contract MDA972-91-C-0030; DARPA Order 8162)
(AD-A244925) Avail: NTIS HC/MF A02 CSCL 09/1

We summarize our first quarter progress and discuss second quarter plans for the development of an edge emitter based vacuum triode with performance goals of 10 u microamp/micron emission current density at less than 250V and which can be modulated at 1 GHz for 1 hour. Device analysis of previously fabricated devices indicate systematic burnout of the edge. This observation indicates that electron heating of the anode and/or current concentration at localized microtips may be causing the burnout. This hypothesis has directed the design of new emitter structures to improve current emission and density. Use of high resistivity thin films as current limiters in emitter diodes has been laid out and will be fabricated in the next reporting period. Tantalum nitride appears to have the proper thin film characteristics for use in these diodes. A variety of other devices for diode and thin film characterization have been laid out for subsequent fabrication in the next several reporting periods. Author (GRA)

N92-20856# Sandia National Labs., Albuquerque, NM.
RAPID LOCALIZATION OF IC OPEN CONDUCTORS USING CHARGE-INDUCED VOLTAGE ALTERATION (CIVA)
E. I. Cole, Jr. and R. E. Anderson 1991 11 p Presented at the IEEE International Reliability Physics Symposium, San Diego, CA, 30 Mar. - 2 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-004481; SAND-91-1850C; CONF-920327-1) Avail: NTIS HC/MF A03

Charged-Induced Voltage Alteration (CIVA) is a scanning electron microscopy technique developed to localize open conductors on both passivated transistors and ICs. CIVA overcomes the limitations usually encountered in localizing open conductors. CIVA images are produced by monitoring the voltage fluctuations of a constant current power supply as an electron beam is scanned over the IC surface. Contrast variations in the CIVA images are generated only from the electrically open portion of a conductor. Because of this high selectivity, CIVA facilitates localization of open interconnections on an entire IC in a single, unprocessed image. The equipment needed to implement CIVA and examples of applying the technique to several failed CMOS ICs are described. Possible radiation effects and methods to minimize them are also discussed. DOE

N92-20861# Argonne National Lab., IL.
INFRARED PROPERTIES OF HIGH T(SUB c) SUPERCONDUCTORS
Z. Schlesinger, L. D. Rotter, R. T. Collins, F. Holtzberg, C. Feild, U. Welp, G. W. Crabtree, J. Z. Liu, Y. Fang, and K. G. Vandervoort 1991 9 p Presented at the International Conference on Materials and Mechanisms of Superconductivity, Kanazawa (Japan), 22-26 Jul. 1991
(Contract W-31-109-eng-38)
(DE92-006994; ANL/CP-75201; CONF-910736-26) Avail: NTIS HC/MF A02

Over the past several years a coherent phenomenology of the high T(sub c) cuprate superconductors has emerged. Infrared measurements contributed several important ingredients to this picture. Chief among those contributions are the following: (1) the inference of a scattering rate that is linear in frequency for omega greater than T, and of order omega; (2) a characteristic energy scale in the superconducting state of 500 cm(exp -1) (60 meV), which can be interpreted as a superconducting pair excitation threshold or energy gap; and (3) evidence for unusual temperature dependence in the vicinity of T(sub c). An attempt to describe these aspects of the data is presented here. DOE

N92-20874# Advanced Research and Applications Corp., Sunnyvale, CA.
A RELIABILITY SIMULATOR FOR RADIATION-HARD MICROELECTRONICS DEVELOPMENT Final Report, 1 Dec. 1989 - 30 Apr. 1991
David H. Huang, Everett E. King, and J. J. Wang Jul. 1991 32 p
(Contract DNA001-89-C-0194)
(AD-A245105; ARACOR-FR793-91) Avail: NTIS HC/MF A03 CSCL 09/1

A real-time reliability simulator to predict device lifetime of n-channel MOSFET transistors due to channel hot-electron (CHE) degradation was developed. The correlation between the x ray radiation induced and hot-electron induced interface state generation was established for both conventional non-LDD and the LDD n-channel devices by using appropriate failure criteria. The correlation has been confirmed by the charge pumping measurements. Software modules were developed to control the hardware of the simulator, collect the data and perform the data analysis. The benefit of this stimulator is dramatically reduced test time. A new hot-carrier stress test procedure has been developed based on the constant gate current stress to evaluate the hot-carrier induced device lifetime of p-channel transistors. This approach ensures a constant electric field near the drain and the constant electron injection rate. It becomes possible to compare the hot-carrier sensitivity of p-channel devices from different process technologies. GRA

N92-20878# Applied Silicon, Inc., Ottawa (Ontario).
DIGITAL SIGNAL PROCESSOR BOARDS AVAILABLE FOR THE ISA BUS
11 Oct. 1990 77 p Sponsored by Defence Research Establishment
(CTN-92-60439) Avail: NTIS HC/MF A05

The Defence Research Establishment Ottawa has a requirement for a high-speed, high-power data processing system for the analysis of pulse Doppler radar data acquired on T-33 aircraft. These data will be acquired in large volumes approaching 1.2 gigabytes at a time. The data analysis is proposed to be

carried out on a microcomputer based on an Intel 80386 processor with an Industry Standard Architecture (ISA) bus. The basic limitation in data analysis is the speed by which the processor can access the data from the mass storage device and the rate at which it can do numerical analysis on this data. Aspects of data processor technology are discussed, including bus structures, accelerator types, choosing suitable accelerator technology, arithmetic in digital signal processing (DSP) systems, and benchmarks. A review of 24 available DSP boards is then provided. Three processor boards are recommended, taking into account tradeoffs in ease of programming, processing speed, and support software. DSP software compilers, libraries, and integrated hardware / software languages are also described to illustrate the variety of tools available to support the various DSP chips. A directory of DSP board vendors is included. CISTI

N92-20887# Prometheus, Inc., Sharon, MA.
APPLICATIONS OF APPROXIMATION THEORY IN ANTENNA DESIGN, SIGNAL PROCESSING, AND FILTERING Final Report, 1 May 1990 - 30 Sep. 1991
James S. Byrnes 26 Nov. 1991 108 p
(Contract F49620-90-C-0023)
(AD-A244725; AFOSR-91-1016TR) Avail: NTIS HC/MF A06 CSCL 09/1

This final report consists of eleven sections. The first is a list of the problems which were considered during the period of performance. Second is the introduction. Third is the paperon beam-forming applications of polynomials with restricted coefficients, which has appeared in the Proceedings of the 1987 NATO ASI on Electromagnetics (Kluwer Academic Publishers, 1991). Fourth is a paper on an ideal omnidirectional transmitting array, and optimal peak factor array, for less than half-wavelength spacing. Fifth is a paper on a random variables method for determining the poles of radar targets. Sixth is a paper on a computationally efficient notch filter. Seventh is a paper on a new rational approximation to digital filters. Eighth is a paper concerning Prony's method. Ninth is a paper on Barker sequences and Littlewood's two-sided conjectures on polynomials with plus or minus 1 coefficients. Tenth is a paper on a note on rational approximations to the Fresnel integral. Eleventh and last is a list of the Prometheus Inc. personnel who performed the research reported herein, and a list of the papers presented at seminars and conferences. Author (GRA)

N92-20888# Minnesota Univ., Minneapolis. Dept. of Chemical Engineering and Materials Science.
DYNAMIC PROCESSES AT SEMICONDUCTOR INTERFACES: ATOMIC INTERMIXING, DIFFUSION BARRIERS, AND STABILITY Final Report, 1 Jun. 1988 - 15 Aug. 1991
J. H. Weaver 15 Aug. 1991 8 p
(Contract DAAL03-88-K-0093)
(AD-A244862; ARO-25163.6-MS) Avail: NTIS HC/MF A02 CSCL 09/1

In our studies of interfacial phenomena, we continually sought to develop new ways to form interfaces. This allowed us to examine the role of kinetics and reaction pathways for surface processes, to gain fundamental new insight into interfacial phenomena, and to synthesize new, possibly useful interface structures. The purpose of the experiments was to change the energy of the arriving flux, giving the ions sufficient energy to induce defect formation and to overcome any activation barriers for reaction. In another, we demonstrated that interfaces could be formed by cluster assembly (the deposition of clusters onto a surface). In a third, we developed a way of forming monlayer-to-multilayer films of oxygen bearing species on surfaces so that oxidation processes and mechanisms could be explored in ways not previously possible. Each of these innovations has given new insight into thin film growth structures and stabilities. GRA

N92-20889# Massachusetts Inst. of Tech., Cambridge.
STUDY OF QUANTUM MECHANICAL EFFECTS IN DEEP SUBMICRON GRATING-GATE FIELD EFFECT TRANSISTORS Annual Technical Report, 1 Oct. 1990 - 30 Sep. 1991
Dimitri Antoniadis Dec. 1991 9 p
(Grant AF-AFOSR-0304-88)
(AD-A244642; AFOSR-91-1012TR) Avail: NTIS HC/MF A02 CSCL 09/1

This research program investigates the effect of extreme submicron and sub-100 nm spatial modulation of the electrostatic potential on the transport of electrons in heterojunction semiconductor devices. The test vehicle is the so-called periodic-gate FET (PGFET), with gate consisting of either a grating or a grid, of 200 nm periodicity. When electrons are made to move in a direction perpendicular to the potential modulation, i.e., perpendicular to the grating along a grid axis, they exhibit a surface superlattice (SSL) effect. When moving along the potential modulation of a grating, electrons are restricted to only one degree of freedom and thus constitute a quasi-one-dimensional (QID) quantum system. Grid-gate FET's have been found to exhibit substantially stronger SSL behavior than their grating-gate counterparts. Electron transport in quantized and spatially periodic systems have studied theoretically and new insights and quantitative calculations have been obtained. Author (GRA)

N92-20890# Naval Ocean Systems Center, San Diego, CA.
VERTICAL NPN BIPOLAR JUNCTION TRANSISTORS FABRICATED IN SILICON-ON-SAPPHIRE
E. N. Cartagena, B. W. Offord, and H. Walker Dec. 1991 4 p
(AD-A244877) Avail: NTIS HC/MF A01 CSCL 09/1

Previous attempts at fabricating vertical bipolar function transistors (BJTs) on Silicon-on-Sapphire (SOS) have produced transistors with low Early voltages, high leakage currents and low current gain. These problems were attributed to high density of microtwin and stacking fault defects at the surface of the silicon which caused enhanced diffusion of the emitter dopant across the base to the collector, resulting in emitter-collector diffusion pipes. By utilizing the Double Solid Phase Epitaxy (DSPE) process and limiting the furnace anneals for the base, emitter and collector dopants the effect of emitter-collector shorts on device performance can be reduced. Vertical NPN bipolar junction transistors were fabricated on DSPE improved SOS using conventional furnace anneals. Transistors with an effective emitter area of 40 square microns were measured for current gain beta (DC) and Early voltage (VA). Functional devices with beta (DC) values of up to 70, VA values of 40 volts and fT values of 2.4 Gigahertz were recorded. Author (GRA)

N92-20938# Sercao, Saint Priest en Jarez (France).
SURVEY OF THE STUDIES CONCERNING THE USE OF PVDF FOR FABRICATING INFRARED DETECTORS [RESUME DES TRAVAUX RELATIFS A L'ADAPTATION DU PVDF POUR LA FABRICATION EN SERIE DE DETECTEURS INFRAROUGES]
Jun. 1991 76 p In FRENCH
(Rept-920/5; ETN-92-90942) Avail: NTIS HC/MF A05

A survey of studies which investigated the industrial application of the Polyvinylidene Fluoride (PVDF) technique is presented. PVDF is usually manufactured into metallized films, and range in thickness from 6 to 40 microns. To characterize the fabrication of infrared detectors, the following tasks are reviewed: theoretical investigations concerning the physical principles; improvements in manufacturing processes by using the PVDF technique on pyroelectric detectors; and technical developments that allowed the fabrication of the first PVDF detectors. The design analysis of a PVDF detector is given. The commercial success of PVDF detectors is a function of its technical competence when compared with other detectors and of its compatibility with industrial requirements. ESA

N92-20947# Metocean Data Systems Ltd., Dartmouth (Nova Scotia).
MINIATURIZATION OF SIGNAL CONDITIONING ELECTRONICS
H. Paul Robinson 28 Jun. 1990 138 p Sponsored by Defence Research Establishment Atlantic
(DREA-CR-91-404; CTN-92-60444) Avail: NTIS HC/MF A07

Previously designed signal conditioning electronics were

reduced in size through the application of surface mount technology. Testing was performed on 120 manufactured units in four steps. Operational electrical tests were performed before temperature cycling, after which full electrical specification testing was carried out. Test results are provided for such parameters as gain and phase, line driver input to output, phase tracking, gain step, calibration input gain and phase, calibration input isolation, noise at output, and supply current. Suggestions were provided for future improvements in noise performance. Circuit changes were recommended which reduced the number of large components, improved circuit stability, and improved electrostatic discharge protection. Author (CISTI)

N92-20971# Fermi National Accelerator Lab., Batavia, IL.
A HIGH PERFORMANCE MULTI-CHANNEL PREAMPLIFIER ASIC
R. J. Yarema, T. Zimmerman, W. Williams, M. Binkley, T. Huffman, and R. Wagner Nov. 1991 7 p Presented at the IEEE Nuclear Science Symposium, Santa Fe, NM, 5-9 Nov. 1991
(Contract DE-AC02-76CH-03000)
(DE92-007201; FNAL/C-91/313; CONF-911106-71) Avail: NTIS HC/MF A02

A new preamplifier, ASIC, has been designed and built to improve performance of the VTPC (Vertex Time Projection Chamber) at Fermilab's Colliding Detector Facility. Design of the semicustom IC was completed using a Tektronix Quick-Chip 2S bipolar linear array. The ASIC has six channels on a chip and provides lower noise, higher gain, lower power, and lower mass packaging than the device which it replaces. Actual performance of the preamplifier was found to match very closely the simulated performance. To reduce the mass of the complete circuit board, bare IC dice were mounted directly on a G-10 substrate using COB (chip on board) techniques. The preamplifier and packaging should be applicable to numerous other systems. DOE

N92-20983# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
[ACTIVITIES OF THE RESEARCH LABORATORY OF ELECTRONICS] Progress Report No. 133, 1 Jan. - 31 Dec. 1990
Jonathan Allen and Daniel Kleppner Aug. 1991 402 p
(Contract DAAL03-89-C-0001)
(AD-A244535; ARO-26213.96-EL) Avail: NTIS HC/MF A18
CSCL 09/1

This progress report contains both a statement of research objectives and a summary of research efforts for research projects listed. Partial contents include: (1) submicron structures technology and research; (2) microstructural evolution in thin films of electronic materials; (3) focused ion beam fabrication; (4) chemical reaction dynamics at surfaces; (5) measurement of electron-phonon interactions through large-amplitude phonon excitation; (6) chemical beam epitaxy of compound semiconductors; (7) high-frequency InAlAs/InGaAs metal-insulator-doped semiconductor field-effect transistors for telecommunications; (8) novel superconducting tunneling structures; (9) optics and quantum electronics; (10) superconducting electronic devices; (11) synchrotron X ray studies of surface disordering; (12) semiconductor surface studies; (13) single electron transistors; (14) quantum optics and photonics; (15) plasma dynamics; (16) electromagnetic wave theory and applications; (17) radio astronomy; (18) digital signal processing; (19) speech processing; (20) custom integrated circuits; (21) speech communication; (22) sensory communications; (23) signal transmission in the auditory system; and (24) linguistics. GRA

N92-20988# Fermi National Accelerator Lab., Batavia, IL.
DESIGN AND PRODUCTION OF A NEW SURFACE MOUNT CHARGE-INTEGRATING AMPLIFIER FOR CDF
C. Nelson and G. Drake 1991 7 p Presented at the IEEE Nuclear Science Symposium, Santa Fe, NM, 5-9 Nov. 1991
(Contract DE-AC02-76CH-03000)
(DE92-007200; FNAL/C-91/318; CONF-911106-72) Avail: NTIS HC/MF A02

We present our experiences in designing and producing 26,000 new charge-integrating amplifiers for CDF, using surface-mount components. The new amplifiers were needed to instrument 920 new 24-channel CDF RABBIT boards, which are replacing an older design rendered obsolete by increases in the collision rate. Important design considerations were frequency response, physical size, and cost. DOE

N92-21010# Colorado Univ., Boulder. Dept. of Electrical and Computer Engineering.
OPTICALLY DRIVEN AND OPTICALLY-CONTROLLED INTEGRATED MILLIMETER-WAVE RECEIVING PHASE ARRAYS Final Report, 1 May 1988 - 30 Apr. 1991
Alan R. Mickelson, David C. Chang, and Lori E. Primas 14 Jul. 1991 5 p
(Contract DAAL03-88-K-0053)
(AD-A244480; ARO-24802.15-EL) Avail: NTIS HC/MF A01
CSCL 09/1

The principal objective of this project is to determine the most efficient means of encoding a microwave/millimeter wave signal from a patch antenna onto an optical carrier in an electro-optical substrate for subsequent optical processing of the microwave/millimeter wave signal. Our approach was to develop design models that would relate the performance of integrated electro-optic devices to the fabrication parameters used in making them and then experimentally verify their performance. From our theoretical and experimental work, it has been shown that it is feasible to build a single side band modulator for millimeter/microwave signals. Currently, our efforts are in improving the design of single side band modulators, investigating alternative substrates and fabrication techniques for electro-optic devices, and designing active elements to be used in conjunction with the antenna elements. Author (GRA)

N92-21042# Sandia National Labs., Albuquerque, NM.
EFFECTS OF FINITE CONDUCTIVITY IN ELECTRORHEOLOGICAL FLUIDS
R. A. Anderson 1991 10 p Presented at the Electrorheological Fluids Conference, Carbondale, IL, 15-16 Oct. 1991
(Contract DE-AC04-76DP-00789)
(DE92-002987; SAND-91-1409C; CONF-9110290-1) Avail: NTIS HC/MF A02

Electrorheological (ER) effects arise from electrostatic forces between particles suspended in a carrier fluid, induced when an electric field is applied. These forces are a consequence of field distortion in the neighborhood of each particle. Although it is known that finite conductivity can influence ER effects, the standard assumption has been that the contrast between the dielectric constants of particles and surrounding fluid is responsible for the field distortion. This is likely to be seriously in error with a low-frequency or direct current (dc) applied field if measurable conductivity is preset in either the particles or fluid. Below a crossover frequency, f(sub c), field distortion becomes dominated by conductivities, and a variety of other complications may arise. Conductive particles could acquire a net charge and fail to participate in chain formation, and a relatively high fluid conductivity may lead to competing processes, including the possibility of a significant distortion of the field distribution in an ER cell. The latter phenomenon is not directly related to f(sub c) and might occur at frequencies above it. Any of these effects could lead to field dependent or frequency dependent behavior of experimental results. DOE

N92-21057# Superconducting Super Collider Lab., Dallas, TX.
PROGRESS IN THE USE OF AVALANCHE PHOTODIODES FOR READOUT FOR CALORIMETERS
H. Fenker, K. Morgan, and T. Regan Sep. 1991 23 p
(Contract DE-AC35-89ER-40486)
(DE92-003602; SSCL-552) Avail: NTIS HC/MF A03

During the past year, the Superconducting Super Collider (SSC) Tracking Group has progressed from acquisition of its first avalanche photodiode (APD) to installation of a 96-channel array of the devices. The work was motivated by the desire to learn how to use APD's as the sensitive elements in a fiber tracking

detector, moderated by the presence of limited resources and the absence of activity within groups outside the SSC Laboratory on such a project. We chose, therefore, to team up with an ongoing research effort which intended to evaluate both pre-shower and shower-maximum detectors and various means of sensing the light produced. The pre-shower detector is made of layers of scintillating fibers similar to a fiber tracker. The shower-maximum detector uses optical fibers to transmit the light from scintillating plates to the readout devices. Our contribution has been to develop the APD array for use in this test from concept to operation. Currently, the equipment is installed in Fermilab's MP beamline awaiting delivery to the final 36 APD's and exposure to the beam. DOE

34 FLUID MECHANICS AND HEAT TRANSFER

Includes boundary layers; hydrodynamics; fluidics; mass transfer; and ablation cooling.

For related information see also *02 Aerodynamics* and *77 Thermodynamics and Statistical Physics.*

N92-20052# Midwest Research Inst., Golden, CO.
INFRARED IMAGING RESULTS OF AN EXCITED PLANAR JET
R. B. Farrington Dec. 1991 7 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC02-83CH-10093)
(DE92-001185; NREL/TP-254-4515; CONF-920436-11) Avail: NTIS HC/MF A02

Planar jets are used for many applications including heating, cooling, and ventilation. Generally such a jet is designed to provide good mixing within an enclosure. In building applications, the jet provides both thermal comfort and adequate indoor air quality. Increased mixing rates may lead to lower short-circuiting of conditioned air, elimination of dead zones within the occupied zone, reduced energy costs, increased occupant comfort, and higher indoor air quality. This paper discusses using an infrared imaging system to show the effect of excitation of a jet on the spread angle and on the jet mixing efficiency. Infrared imaging captures a large number of data points in real time (over 50,000 data points per image) providing significant advantages over single-point measurements. We used a screen mesh with a time constant of approximately 0.3 seconds as a target for the infrared camera to detect temperature variations in the jet. The infrared images show increased jet spread due to excitation of the jet. Digital data reduction and analysis show change in jet isotherms and quantify the increased mixing caused by excitation. DOE

N92-20120*# MCAT Inst., San Jose, CA.
ALGORITHM AND CODE DEVELOPMENT FOR UNSTEADY THREE-DIMENSIONAL NAVIER-STOKES EQUATIONS Annual Report
Shigeru Obayashi Mar. 1992 29 p Original contains color illustrations
(Contract NCC2-605)
(NASA-CR-190149; NAS 1.26:190149; MCAT-92-005) Avail: NTIS HC/MF A03; 2 functional color pages CSCL 20D

A code, ENSAERO, is being developed for computing the unsteady aerodynamics and aeroelasticity of aircraft and it solves the Euler and/or Navier-Stokes equations. The code was extended to complicated geometries, such as wing-body configuration, and wing with oscillating control surface. Comparisons with available experimental data show reasonable agreement with the use of relatively coarse grids. Author

N92-20121# Stanford Univ., CA. Dept. of Chemical Engineering.
FUNDAMENTAL STUDIES OF FLUID MECHANICS AND STABILITY IN POROUS MEDIA
G. M. Homsy Aug. 1991 9 p
(Contract DE-FG03-87ER-13673)
(DE92-005268; DOE/ER-13673/T2) Avail: NTIS HC/MF A02

This report summarizes accomplished and proposed work for the fundamental studies of fluid mechanics and stability in porous media. Topics discussed include: viscous fingering in miscible displacements; polymer flow interactions in free shear layers of viscoelastic fluids; and effect of nonmonotonic viscosity profiles on the stability of miscible displacements in porous media. DOE

N92-20147 Purdue Univ., West Lafayette, IN.
INVARIANT BOUNDARY CONDITIONS FOR CASCADE FLOWS Ph.D. Thesis
Terry Lee Caipen 1991 222 p
Avail: Univ. Microfilms Order No. DA9201310

A method of using the phase lagged Riemann invariant boundary conditions was developed to compute the aerodynamic response coefficients for cascade flows. The method is used with a quasi-Newton iteration technique to solve the unsteady full potential equation. The results are compared with a time sheared boundary condition scheme for nonzero interblade phase angles. The current method eliminates the need for using multiple passages in such calculations and automatically gives the proper wake jump conditions for the potential equation. The results are also compared to available theoretical and experimental results for subsonic, transonic, and supersonic (with subsonic leading edge locus) flows to establish the validity and accuracy of the result. The method can be used to more efficiently calculate the flutter boundaries of a cascade geometry at many interblade phase angles.
Dissert. Abstr.

N92-20180# Max-Planck-Inst. fuer Stroemungsforschung, Goettingen (Germany, F.R.).
STOCHASTIC PERTURBED SYSTEMS: THEORY AND PRACTICE OF KARMAN VORTEX STREETS Thesis [UEBER STOCHASTISCH GESTOERTE SYSTEME: THEORIE UND ANWENDUNG AUF DIE KARMANSCHE WIRBELSTRASSE]
Joerg Holtfort May 1991 77 p In GERMAN; ENGLISH summary Sponsored by DFG
(MPIS-4/1991; ISSN-0436-1199; ETN-92-91014) Avail: NTIS HC/MF A05

In the theory of randomly perturbed dynamical systems developed by Friedlin and Wentzell, the potential of a vectorfield is generalized to the so called quasipotential. For general nonlinear systems, the quasipotential turns out to be nondifferentiable along certain lines. These lines are investigated numerically for bistable systems with at least one limit cycle. It is found that even for strong nonlinearity, the quasipotential remains smooth in a finite neighborhood of the stable limit cycle. This formalism is used for the reconstruction of dynamical systems for measured time series. The method is successfully applied to velocity measurements in a Karman vortex street at Reynolds numbers 60 to 150. ESA

N92-20230# Laboratoire de Meteorologie Dynamique du CNRS, Palaiseau (France).
FORMATION AND STABILITY OF A SEMI-INFINITE VORTICITY LINE UNDER AN ADHERENCE CONDITION Final Report [FORMATION ET STABILITE D'UNE LIGNE SEMI-INFINIE DE VORTICITE SOUMISE A UNE CONDITION D'ADHERENCE. RAPPORT FINAL]
Michele Larcheveque 1991 13 p In FRENCH
(Contract DRET-88-1215)
(ETN-92-91075) Avail: NTIS HC/MF A03

Formation and stability of vortices, whose lifetime is long in face of their rotation characteristic, are addressed. The adherence condition, to a wall orthogonal to the vortex axis, imposed by the flow is studied specifically. A mathematical model of the vortex origin is proposed which applies not only to meteorological tornado phenomena, but to hydrodynamics, in the draining of basins, and magnetohydrodynamics, in terms of plasma confinement. ESA

N92-20232# Institut National des Sciences Appliquees, Routen (France).
MARCO CONTRACT REPORT [RAPPORT DE CONTRAT MARCO]
Yann Lebret and Dany Vandromme 1991 110 p In FRENCH (Contract DRET-89-216)
(ETN-92-91077) Avail: NTIS HC/MF A06

Numerical flow computation in the mixing layer is addressed. The physical process is described and a resolution algorithm for the Navier-Stokes equations, using a second order explicit-implicit predictor-corrector MacCormack scheme, is given. Turbulence models which were previously developed are reviewed. Results and conclusions are given. ESA

N92-20235*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
HEAT TRANSFER IN ROTATING SERPENTINE PASSAGES WITH TRIPS SKEWED TO THE FLOW
B. V. Johnson, J. H. Wagner, G. D. Steuber (Pratt and Whitney Aircraft, East Hartford, CT.), and F. C. Yeh 1992 13 p Proposed for presentation at the 37th ASME International Gas Turbine and Aeroengine Congress and Exposition, Cologne, Germany, 1-4 Jun. 1992; sponsored by the 1992 AMSE Turbo Expo-Land, Sea and Air
(NASA-TM-105581; E-6908; NAS 1.15:105581) Avail: NTIS HC/MF A03 CSCL 20D

Experiments were conducted to determine the effects of buoyancy and Coriolis forces on heat transfer in turbine blade internal coolant passages. The experiments were conducted with a large scale, multi-pass, heat transfer model with both radially inward and outward flow. Trip strips, skewed at 45 deg to the flow direction, were machined on the leading and trailing surfaces of the radial coolant passages. An analysis of the governing flow equations showed that four parameters influence the heat transfer in rotating passages: coolant-to-wall temperature, rotation number, Reynolds number, and radius-to-passage hydraulic diameter ratio. The first three of these four parameters were varied over ranges which are typical of advanced gas turbine engine operating conditions. Results were correlated and compared to previous results from similar stationary and rotating models with smooth walls and with trip strips normal to the flow direction. The heat transfer coefficients on surfaces, where the heat transfer decreased with rotation and buoyancy, decreased to as low as 40 percent of the value without rotation. However, the maximum values of the heat transfer coefficients with high rotation were only slightly above the highest levels previously obtained with the smooth wall models. It was concluded that (1) both Coriolis and buoyancy effects must be considered in turbine blade cooling designs with trip strips, (2) the effects of rotation are markedly different depending upon the flow direction, and (3) the heat transfer with skewed trip strips is less sensitive to buoyancy than the heat transfer in models with either smooth or normal trips. Therefore, skewed trip strips rather than normal trip strips are recommended and geometry-specific tests are required for accurate design information. Author

N92-20238 California Inst. of Tech., Pasadena.
QUANTUM CRITICAL PHENOMENA IN SUPERFLUIDS AND SUPERCONDUCTORS Ph.D. Thesis
Kihong Kim 1991 108 p
Avail: Univ. Microfilms Order No. DA9137250

Some problems are discussed which are related to quantum critical phenomena in superfluids and superconductors. Generalizations of hyperuniversality are applied to quantum phase transitions at zero temperature. New universal amplitude combinations are found which involve the superfluid density in Bose systems, as well as confirm and extend previous proposals for universal transport coefficients in 2-D superconducting films and magnetic field induced metal insulator transitions. The double dimensionality expansion of Dorogovstev is applied to derive renormalization group recursion relations for a Bose fluid in a random external potential. A nontrivial fixed point was found. The onset of mean field behavior for dimensions d less than d sub c = 4 is unconventional, yielding discontinuous exponents. Including positive temperatures, a clear picture is given of various crossover regimes. A detailed derivative is given to the critical thermodynamics of O(n) spin models, correct to O(epsilon = 4 - d), using a generalization of the renormalization group trajectory integral and noncritical matching technique introduced by Rudnick and Nelson. Dissert. Abstr.

N92-20242*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
MODELING THE FILM CONDENSATE FLUID DYNAMICS AND HEAT TRANSFER WITHIN THE BUBBLE MEMBRANE RADIATOR
K. A. Pauley (Pacific Northwest Lab., Richland, WA.) and J. O. Thornborrow Jan. 1992 10 p Presented at the 9th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 13-16 Jan. 1992
(Contract DE-AC06-76RL-01830)
(NASA-TM-107804; NAS 1.15:107804; DE92-006725; PNL-SA-20090; CONF-920104-25) Avail: NTIS HC/MF A02 CSCL 20D

An analytical model of the fluid dynamics and heat transfer characteristics of the condensate within the rotating Bubble Membrane Radiator is developed. The steady-state, three-dimensional heat transfer and flow equations were reduced to a set of third-order ordinary differential equations by employing similarity transformation techniques. These equations are then solved for the radial, axial, and angular flow distributions in the film condensate. Pressure, temperature, heat transfer, film thickness and mass flow rate distributions are also calculated. The analytical model is the basis of the SCRABBLE code which is used both as a zero-g design tool and a ground-test bed analyzer. DOE

N92-20289# National Inst. of Standards and Technology, Gaithersburg, MD. Applied and Computational Mathematics Div.
EFFECT OF GRAVITY MODULATION ON THERMOSOLUTAL CONVECTION IN AN INFINITE LAYER OF FLUID
B. V. Saunders, B. T. Murray, G. B. McFadden, S. R. Coriell, and A. A. Wheeler Oct. 1991 42 p
(PB92-112291; NISTIR-4679) Avail: NTIS HC/MF A03 CSCL 20D

The effect of time-periodic vertical gravity modulation on the onset of thermosolutal convection in an infinite horizontal layer with stress free boundaries is studied using Floquet theory for the linear stability analysis. Situations are considered for which the fluid layer is stably stratified in either the fingering or diffusive regimes of double diffusive convection. Results are presented both with and without steady background acceleration. Modulation may stabilize an unstable base solution or destabilize a stable base solution. In addition to synchronous and subharmonic response to the modulation frequency, instability in the double diffusive system can occur via a complex conjugate mode. In the diffusive regime, where oscillatory onset occurs in the unmodulated system, regions of resonant instability occur and exhibit strong coupling with the unmodulated oscillatory frequency. Author

N92-20300 California Inst. of Tech., Pasadena.
NUMERICAL STUDIES OF NONLINEAR AXISYMMETRIC WAVES ON VORTEX FILAMENTS Ph.D. Thesis
Vidyadhar Yogeshwar Mudkavi 1991 263 p
Avail: Univ. Microfilms Order No. DA9137271

The equations of Moore & Saffman are examined and are shown to contain the fast time scale equations governing the core waves on a straight vortex filament. The equations so derived are the same as those reported by Lundgren & Ashurst except for a correction term that allows for variation of the axial velocity structure within the vortex core. Numerical solutions of the Moore & Saffman equations are presented for various initial conditions consisting of wave-like perturbations on a cylindrical vortex, and they all show development of a jump (shock) in the core area. This was advanced to be a mechanism for vortex breakdown by Lundgren & Ashurst. A comparison of the solutions of Moore & Saffman equations with solutions of the Navier-Stokes equations

at high Reynolds number is presented for three different cases. Next, an extension of steady Kelvin waves for two different types of vorticity profiles is considered, both of which show regions of reversed flow. Next, an analysis of the weakly nonlinear stability of a columnar vortex is presented. It is shown that the amplitude satisfies a cubic nonlinear Schroedinger equation. Solutions are found to be numerically unstable in which case solitary wave solutions are possible. Dissert. Abstr.

N92-20314 University Coll. of Wales, Aberystwyth.
PROBLEMS IN NON-NEWTONIAN FLUID MECHANICS Ph.D. Thesis
Octavio Manero 1980 245 p
Avail: Univ. Microfilms Order No. BRDX93995

The rheological behavior of industrial liquids such as polymer solutions in complex flow situations and the possibility of predicting this behavior are addressed. Preliminary consideration is given to the rheometrical characterization of several elastico-viscous test solutions. Results of simple shear flow and oscillatory shear flow measurements are shown. These data enable us to choose the most appropriate solutions for our experimental studies. Implicit models of the Oldroyd-Maxwell type are chosen as our constitutive equations to characterize the complex behavior of the liquids considered. These models retain the simplicity necessary to solve complicated flow problems. The numerical method chosen to solve the very complex equations governing the flow of elastic liquids in complex flow situations is discussed. The method is of the generalized conjugate gradient type with incomplete LU-decomposition. This is used to solve the discretized equations using finite differences with central difference formula. The first flow problem considered deals with two unsteady pipe flows. Since experimental data for both are available, we attempt to simulate the experimental results using a conventional perturbation method and a more sophisticated finite difference technique employing the full set of equations. It is concluded that in the vibrating pipe situation the flow must be considered dominated by the axial movement of the pipe. Attention is devoted to the flow of elastic liquids in situations involving abrupt changes in geometry. Associated with this situation is the problem of determining the pressure field and in many publications the pressure solution is not included. The numerical determination of pressure fields in the L-shaped geometry is considered. Experimental pressure drop measurements are described which facilitate a comparison between theory and experiment. The relevant computer program is shown. The problem of the slow flow of elastic liquids past circular cylinders is addressed. An experimental flow visualization technique is described and used to photograph the streamline patterns.
Dissert. Abstr.

N92-20317 Bath Univ. (England).
EXPERIMENTAL AND ANALYTICAL STUDIES OF JETS IN QUIESCENT OR ROTATING FLOW FIELDS Ph.D. Thesis
X. P. Gan 1990 384 p
Avail: Univ. Microfilms Order No. BRDX93713

A technique of analyzing two-dimensional flow by thermal anemometry measurements was developed. It is capable of deriving the information of instantaneous velocity, mean velocity, and turbulence instensity. However, this technique suffers from the inability to discriminate the velocity direction; hence, there is some inaccuracy in both mean velocity and turbulence intensity in the case of low velocity or for the measurement of a small velocity component. To improve the data analysis technique, it was necessary to combine it with the detection of velocity direction. Measurements were performed in a hydraulic analog rig to simulate the fuel injection process in a direct injection diesel engine, using the hot film anemometry technique and the two-dimensional data analysis method developed. Both steady state and transient injection were studied. In each case, the injection process is studied with the jet subjected to a different degree of deflection. The velocity decay along the jet centerline of the undeflected jet was compared with the centerline velocity decay of open jets. The decay of a deflected jet along its axis is more difficult to describe because of a lack of knowledge about the exact location of the jet axis or the jet centerline. This difficulty becomes more considerable for the transient jet. Discussion was concentrated on the mean velocity components and the turbulent fluctuation within the jet envelope and in the vicinity of jet shear layer boundary. Turbulence intensity distribution is affected by two factors: the relative velocity between the jet and the surrounding fluid; and the interference between the jet and the swirl. A symmetric distribution of both mean velocity and the turbulence intensity is observed for the undeflected jet. However, with swirl present, the symmetry was destroyed; the resulting jet has a thin outer boundary and a thick inner boundary. Dissert. Abstr.

N92-20322 Michigan Univ., Ann Arbor.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF THE HEAT TRANSFER DURING IMPACT Ph.D. Thesis
Farouk Ben-Ammar 1991 105 p
Avail: Univ. Microfilms Order No. DA9135556

The problem of conduction heat transfer between two bodies in contact over a bounded region for very short periods of time is considered. The analytical-numerical determination of the interfacial heat flux between these contacting bodies is addressed. For particles impacting a surface of a different temperature, an experimental method for the measurement of the conductive heat transfer between the particles and the surface is developed. Factors such as the plastic deformation induced in the collector due to the relatively high velocities of impact, and the flexibility of the collector support, can influence the conductive heat transfer. The effects of oblique impact and particle spin are also examined. The transient conduction equation is used to estimate the contact resistance and the conductive heat flux between two bodies in contact for very short periods of time is obtained. An experimental apparatus is designed and fabricated for the measurement of the conductive heat transfer during the impact of spherical metallic particles with small metallic collectors embedded in low thermal conductivity substrates. The experimental results are presented for various collector materials. A theoretical model is developed for heat transfer during a fully plastic impact. Another model for the heat transfer is developed using the work-hardening of the collector. The effect of the hardness of the collector on the heat exchange is studied. The effect of the flexibility of the collector support on the heat transfer is examined by using an existing model of an elastic half-space. The experimental results show that the measured heat transfer during impact is larger than that obtained from the prediction of the elastic impact model. This is mainly the result of the plastic deformation of the collector during impact. The results of the flexible support model show that the flexibility can increase or decrease the heat transfer during multiple impacts. Dissert. Abstr.

N92-20330 California Inst. of Tech., Pasadena.
AN EXPERIMENTAL INVESTIGATION OF STRUCTURE, MIXING AND COMBUSTION IN COMPRESSIBLE TURBULENT SHEAR LAYERS Ph.D. Thesis
Jeffery Lawrence Hall 1991 138 p
Avail: Univ. Microfilms Order No. DA9137236

Two-dimensional, compressible, turbulent shear layers are studied in a new wind tunnel facility. Both reacting and non-reacting flows are investigated, with one free stream velocity supersonic and the other subsonic. The combustion experiments are based on the use of low concentrations of hydrogen, nitric oxide, and fluorine gases. Side-view Schlieren photographs of these reacting and non-reacting flows appear devoid of the two-dimensional, large-scale structures seen in incompressible flows. Comparison with all subsonic flows produced in the same facility suggests that this lack of two-dimensional structure is due to the presence of the supersonic high-speed free stream velocity. Travelling shock and expansion waves are observed in the high compressibility flows, evidently created by turbulent structures convecting at supersonic velocities. Such waves are seen only in the low-speed fluid, with apparent convection velocities much higher than those predicted on the basis of isentropic pressure-matching arguments. The measured shear layer growth rates agree with previous results by other experimenters, except for a few cases at low

compressibility and low density ratio. The fast chemistry regime is attained in some of the high compressibility flows tested. Flip experiments conducted in this regime indicate that the volume fraction of mixed fluid in the layer is substantially reduced as compared to previous incompressible results. These same flip experiments also reveal that compressibility significantly alters the entrainment ratio. Finally, it is observed that the shear layer growth rate is relatively insensitive to incident shock/expansion waves and significant heat release inside the shear layer.

Dissert. Abstr.

N92-20338# Michigan Technological Univ., Houghton. Dept. of Mechanical Engineering and Engineering Mechanics.

ELECTROSTATIC ENHANCEMENT OF HEAT TRANSFER IN GAS-TO-GAS HEAT EXCHANGERS Final Report, Jun. 1987 - Mar. 1991

M. M. Ohadi Jun. 1991 102 p

(Contract GRI-5087-260-1528)

(PB92-123744; GRI-91/0202) Avail: NTIS HC/MF A06 CSCL 20D

Basic study of electrohydrodynamic (EHD) enhancement of heat transfer in heat exchangers was the subject of an investigation. The author's efforts over the three-year project time period can be categorized into three consecutive phases. In phase 1, EHD heat transfer enhancements and pressure drop characteristics for conventional pipe flows as a function of electric field potential, field polarity, number of electrodes (single or double configuration), and flow regime (Reynolds number ranging from fully laminar to fully turbulent conditions) were studied. Study of heat transfer enhancements and pressure drop characteristics in a shell-and-tube, gas-to-gas heat exchanger were performed in Phase 2 of the project. To address the applicability of the EHD technique under operating conditions of gas-fired equipment, the role of various working fluid properties were studied in Phase 3 of the project. Specifically, effects of working fluid humidity, temperature, pressure, and impurity level on the magnitude and nature of the EHD heat transfer enhancements were studied. A maximum of 322 percent heat transfer enhancement with only 112 percent increase in pressure drops was achieved under simultaneous excitation of the tube and shell sides of the heat exchanger in the study. With optimized electric and flow field parameters, much higher enhancements can be expected. GRA

N92-20372*# Houston Univ., TX. Dept. of Mechanical Engineering.

ELLIPTIC JETS, PART 2. DYNAMICS OF COHERENT STRUCTURES: PAIRING

Hyder S. Husain and Fazle Hussain 24 Feb. 1992 58 p Previously announced in IAA as A92-19962

(Contract NAG3-639; DE-FG05-88ER-13839)

(NASA-CR-189902; NAS 1.26:189902) Avail: NTIS HC/MF A04 CSCL 20D

The dynamics of the jet column mode of vortex pairing in the near field of an elliptic jet was investigated. Hot-wire measurements and flow visualization were used to examine the details of the pairing mechanism of nonplanar vortical elliptic structures and its effect on such turbulence measures as coherent velocities, incoherent turbulence intensities, incoherent and coherent Reynolds, stresses, turbulence production, and mass entrainment. It was found that pairing of elliptic vortices in the jet column does not occur uniformly around the entire perimeter, unlike in a circular jet. Merger occurs only in the initial major-axis plane. In the initial minor-axis plane, the trailing vortex rushes through the leading vortex without pairing and then breaks down violently, producing considerably greater entrainment and mixing than in circular or plane jets. Author

N92-20377 California Inst. of Tech., Pasadena.

AN EXPERIMENTAL INVESTIGATION OF CHEMICALLY REACTING, GAS PHASE TURBULENT JETS Ph.D. Thesis

Richard Joseph Gilbrech 1991 95 p

Avail: Univ. Microfilms Order No. DA9137231

A new high pressure combustion facility was built to investigate mixing in axisymmetric, turbulent jets exiting into quiescent reservoirs. The facility uses fluorine and nitric oxide, diluted with nitrogen, for chemical product formation that is accompanied by heat release. The average temperature was measured by a set of long, thin, resistance wire thermometers stretched across the jet centerline at 16 downstream locations from x/d0 = 30 to 240. Runs at several stoichiometric mixture ratios phi, for Reynolds numbers ranging from 10,000 less than or equal to Re less than or equal to 150,000, were performed to determine any dependence of flame length on Reynolds number. The Reynolds number was varied through density i.e., pressure, while the jet exit velocity and exit diameter were held constant. The time-averaged line integral of temperature, measured along the transverse axis of the jet by the wires, displays a logarithmic dependence on x/d* within the flame zone, and asymptotes to a constant value beyond the flame tip, as predicted from scaling and similarity arguments for a momentum-dominated, turbulent jet. The main result of the work is that the flame length, as estimated from the temperature measurements, varies with changes in Reynolds number, suggesting that the mixing process is not Reynolds number independent up to Re = 150,000. Specifically, the normalized flame length L(sub f)/d* displays a linear dependence on phi, with a slope that decreases from Re = 10,000 to 20,000, and then remains constant for Re greater than 20,000.

Dissert. Abstr.

N92-20379 Arizona Univ., Tucson.

NUMERICAL SIMULATION OF THE CONTROL OF WAVE PACKET DISTURBANCES IN THE BOUNDARY LAYER ON A FLAT PLATE Ph.D. Thesis

Peter Aloisius Dittrich 1991 151 p

Avail: Univ. Microfilms Order No. DA9136844

The control of the transition from laminar to turbulent flow in a boundary layer of a flat plate is studied using numerical simulations. The numerical model is based on the incompressible Navier-Stokes equations, which is coupled with the energy equation through the temperature dependent viscosity. A fully implicit finite difference spectral method was used to solve the governing equations. The numerical model allows for the spatial evolution of the disturbances in a nonparallel boundary layer. Active control of wave packet disturbances in the nonisothermal boundary layer is studied in detail. Wave packet disturbances are created in the flow field by simulating the effect of thermally activated heater elements on the plate surface. Through a controlled spanwise variation of the temperature of the heater elements, 2-D and 3-D wave packet disturbances can be studied. The propagation and amplification of the wave packet disturbances in the boundary layer is examined. The heater elements on the plate surface act as locally strong heat sources causing thermal wakes within the boundary layer that spread in the downstream direction. A transfer function technique is used for the control strategy. Dissert. Abstr.

N92-20392# Technische Univ., Delft (Netherlands).

THE IMPLEMENTATION AND ANALYSIS OF AN ALGORITHM ORIENTED PROCESSOR FOR SOLVING THE NAVIER-STOKES EQUATIONS Ph.D. Thesis

Franciscus Ferdinand vanderVlugt 1991 129 p Sponsored in part by Netherlands Technology Foundation

(ETN-92-90879) Avail: NTIS HC/MF A07

The implementation and analysis of a flow algorithm in the DNSP (Delft Navier-Stokes Processor) is described. The flow algorithm is used for the solution of natural convection problems in two and three dimensional cavities. The flow in the cavity is described by the Navier-Stokes equations, the continuity equation and the energy equation. Turbulence is modeled with the k-epsilon model from which two extra convection diffusion equations are added. The partial differential equations are discretized by using a finite volume method. For the pressure velocity coupling the SIMPLE method is used. The equations are discretized on one vertical line in the calculation domain; after solution of the difference equations one of its neighboring lines is to be solved. Discussions on parallel computers and software for parallel computers give a better understanding of algorithms on parallel computers. ESA

N92-20409*# West Virginia Univ., Morgantown. Dept. of Mechanical and Aerospace Engineering.
ACOUSTIC FORCING OF A LIQUID DROP Final Report
M. J. Lyell Feb. 1992 212 p
(Grant NAG3-1005)
(NASA-CR-190086; NAS 1.26:190086) Avail: NTIS HC/MF A10 CSCL 20D

The development of systems such as acoustic levitation chambers will allow for the positioning and manipulation of material samples (drops) in a microgravity environment. This provides the capability for fundamental studies in droplet dynamics as well as containerless processing work. Such systems use acoustic radiation pressure forces to position or to further manipulate (e.g., oscillate) the sample. The primary objective was to determine the effect of a viscous acoustic field/tangential radiation pressure forcing on drop oscillations. To this end, the viscous acoustic field is determined. Modified (forced) hydrodynamic field equations which result from a consistent perturbation expansion scheme are solved. This is done in the separate cases of an unmodulated and a modulated acoustic field. The effect of the tangential radiation stress on the hydrodynamic field (drop oscillations) is found to manifest as a correction to the velocity field in a sublayer region near the drop/host interface. Moreover, the forcing due to the radiation pressure vector at the interface is modified by inclusion of tangential stresses. Author

N92-20454# National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
CONVECTIVE BOUNDARY LAYER STRUCTURE OBSERVED DURING ROSE-1 USING THE NOAA 915 MHz RADAR WIND PROFILER
A. B. White and C. W. Fairall Jul. 1991 64 p
(PB91-241331; NOAA-TM-ERL-WPL-205) Avail: NTIS HC/MF A04 CSCL 20D

Time series of radar wind profiler and sodar reflectivity data were analyzed to extract a continuous record of mixing depths in the convective planetary boundary layer (CPBL). Results indicate that radar signal to noise ratio (SNR) data can be used to successfully monitor the elevated inversion heights associated with convective development. Mixing depths in the lowest 200 m (i.e., occurring at night) were determined from sodar facsimile records. In addition to the SNR, vertical velocities and Doppler spectral widths measured by the radar were analyzed to further define CPBL structure. Profiles of vertical velocity variance and skewness derived from high temporal resolution radar data agree with previous observations. The radar derived skewness profile also indicates a peak in skewness just below the height of the capping inversion. Although previously unobserved, this feature occurs frequently in large eddy simulation model results. Estimates of the turbulence kinetic energy dissipation rate determined from radar spectral widths appear to be about a factor of two too low.
Author

N92-20485 Toledo Univ., OH.
A LASER VELOCIMETER INVESTIGATION OF THE NORMAL SHOCKWAVE BOUNDARY LAYER INTERACTION Ph.D. Thesis
Randall Marshall Chriss 1991 124 p
Avail: Univ. Microfilms Order No. DA9200762

Non-intrusive three-dimensional measurements have been made of a normal shock wave/turbulent boundary layer interaction. The measurements were made throughout a quadrant of a square test section of a continuous flow supersonic wind tunnel in which a normal shock wave was stabilized. Two-dimensional measurements were made throughout the interaction region while three-dimensional measurements were made near the corner in the vicinity of the shock where three-dimensional flow effects were expected to be significant. Laser Doppler velocimetry, surface static pressure measurements and flow visualization techniques were employed for two freestream nominal Mach number test cases: 1.6 and 1.3. No turbulence information was obtained. The mean velocity measurements were converted to Mach number by recording the wind tunnel total temperature. Some shock oscillation was present during both of the test cases. After startup of the wind tunnel, the shock oscillation amplitude was greatly reduced, as evidenced by the laser velocimeter results. The Mach 1.3 test case resulted in a nearly uniform flow without secondary shock waves and with no or very isolated corner separation. The Mach 1.6 test case contained separated flow regions and a system of secondary shock waves. The reported results are believed to accurately describe the flowfield of each case and may find use in the verification of numerical simulation. Dissert. Abstr.

N92-20497# Aix-Marseilles Univ. (France). Equipe Aerodynamique et Bruit de Champ Proche.
EXPERIMENTAL STUDY OF THE WALL PRESSURE FLUCTUATIONS UNDER A TURBULENT BOUNDARY LAYER DOWNSTREAM OF TANDEM AEROFOIL EXTERNAL MANIPULATORS Ph.D. Thesis [ETUDE EXPERIMENTALE DES FLUCTUATIONS DE PRESSION PARIETALE SOUS UNE COUCHE LIMITE TURBULENTE EN AVAL D'UN DISPOSTIF DE DEUX MANIPULATEURS EXTERNES DE TYPE PROFIL AVIATION PLACES EN TANDEM]
Philippe Olivero 1990 176 p In FRENCH; ENGLISH summary
(Rept-207-90-78; ETN-92-90951) Avail: NTIS HC/MF A09

The boundary layer alteration downstream of a tandem of aerofoil external manipulators was evaluated by mean and turbulent characteristic measurements. The results show that the manipulated boundary layer structure remains identical to the natural one's. The local skin friction reaches a maximum of 20 percent at 36 boundary layer thicknesses downstream the device and then persists up to 100 boundary layer thicknesses, where it is still 10 percent. Technical methods based on two or four transducers, used to remove contamination noise caused by the acoustic sources, allow a better description of the wall pressure convective properties. Auto and interspectral density level reductions are found. They agree with the local skin friction reduction of the high frequency range whereas the spectral level is more reduced in the relaxation zone. Low wavenumber level measurements are performed at the maximum local skin friction reduction zone with a six flush mounted microphones array. They appear more reduced than if it was attempted only by the local skin friction reduction. Conditional averaging techniques were performed to find the link between wall pressure fluctuations field and turbulence producing mechanisms which were attempted to be the most altered by the manipulation. ESA

N92-20511# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Hauptabt. Energie- und Anlagentechnik.
THE DYNAMICS OF HEAT TRANSFER IN A TURBULENT PIPE FLOW
Heinz Schmidl Feb. 1991 87 p In GERMAN; ENGLISH summary
(OEFZS-4571; ETN-92-90641) Copyright Avail: NTIS HC/MF A05

The temperature distribution of a turbulent pipe flow is described using a system of differential equations which are solved by changing several parameters. A pipe line at the inlet of which a jump on temperature occurs in the fluid is examined. The calculations are supported by corresponding computer programs.
ESA

N92-20514*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
COMPRESSIBLE HOMOGENEOUS SHEAR: SIMULATION AND MODELING Final Report
S. Sarkar, G. Erlebacher, and M. Y. Hussaini Feb. 1992 28 p Submitted for publication
(Contract NAS1-18605)
(NASA-CR-189611; NAS 1.26:189611; ICASE-92-6) Avail: NTIS HC/MF A03 CSCL 20D

Compressibility effects were studied on turbulence by direct numerical simulation of homogeneous shear flow. A primary observation is that the growth of the turbulent kinetic energy decreases with increasing turbulent Mach number. The sinks provided by compressible dissipation and the pressure dilatation,

along with reduced Reynolds shear stress, are shown to contribute to the reduced growth of kinetic energy. Models are proposed for these dilatational terms and verified by direct comparison with the simulations. The differences between the incompressible and compressible fields are brought out by the examination of spectra, statistical moments, and structure of the rate of strain tensor. Author

N92-20520*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
IMPLEMENTATION/VALIDATION OF A LOW REYNOLDS NUMBER TWO-EQUATION TURBULENCE MODEL IN THE PROTEUS NAVIER-STOKES CODE: TWO-DIMENSIONAL/AXISYMMETRIC
Trong T. Bui Apr. 1992 21 p
(NASA-TM-105619; E-6955; NAS 1.15:105619) Avail: NTIS HC/MF A03 CSCL 20D

The implementation and validation of the Chien low Reynolds number k-epsilon turbulence model in the two dimensional axisymmetric version Proteus, a compressible Navier-Stokes computer code, are presented. The set of k-epsilon equations are solved by marching in time using a coupled alternating direction implicit (ADI) solution procedure with generalized first or second order time differencing. To validate Proteus and the k-epsilon turbulence model, laminar and turbulent computations were done for several benchmark test cases: incompressible fully developed 2-D channel flow; fully developed axisymmetric pipe flow; boundary layer flow over a flat plate; and turbulent Sajben subsonic transonic diffuser flows. Proteus results from these test cases showed good agreement with analytical results and experimental data. Detailed comparisons of both mean flow and turbulent quantities showed that the Chien k-epsilon turbulence model given good results over a wider range of turbulent flow than the Baldwin-Lomax turbulence model in the Proteus code with no significant CPU time penalty for more complicated flow cases. Author

N92-20669*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
STS-40 ORBITAL ACCELERATION RESEARCH EXPERIMENT FLIGHT RESULTS DURING A TYPICAL SLEEP PERIOD
R. C. Blanchard, J. Y. Nicholson, and J. R. Ritter (Lockheed Engineering and Sciences Co., Hampton, VA.) Jan. 1992 28 p
(NASA-TM-104209; NAS 1.15:104209) Avail: NTIS HC/MF A03 CSCL 20D

The Orbital Acceleration Research Experiment (OARE), an electrostatic accelerometer package with complete on-orbit calibration capabilities, was flown for the first time aboard the Space Shuttle on STS-40. This is also the first time an accelerometer package with nano-g sensitivity and a calibration facility has flown aboard the Space Shuttle. The instrument is designed to measure and record the Space Shuttle aerodynamic acceleration environment from the free molecule flow regime through the rarified flow transition into the hypersonic continuum regime. Because of its sensitivity, the OARE instrument defects aerodynamic behavior of the Space Shuttle while in low-earth orbit. A 2-hour orbital time period on day seven of the mission, when the crew was asleep and other spacecraft activities were at a minimum, was examined. During the flight, a 'trimmed-mean' filter was used to produce high quality, low frequency data which was successfully stored aboard the Space Shuttle in the OARE data storage system. Initial review of the data indicated that, although the expected precision was achieved, some equipment problems occurred resulting in uncertain accuracy. An acceleration model which includes aerodynamic, gravity-gradient, and rotational effects was constructed and compared with flight data. Examination of the model with the flight data shows the instrument to be sensitive to all major expected low frequency acceleration phenomena; however, some erratic instrument bias behavior persists in two axes. In these axes, the OARE data can be made to match a comprehensive atmospheric-aerodynamic model by making bias adjustments and slight linear corrections for drift. The other axis does not exhibit these difficulties and gives good agreement with the acceleration model. Author

N92-20677*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
SIMULATION OF REAL-GAS EFFECTS ON PRESSURE DISTRIBUTIONS FOR AEROASSIST FLIGHT EXPERIMENT VEHICLE AND COMPARISON WITH PREDICTION
John R. Micol Apr. 1992 70 p
(NASA-TP-3157; L-16923; NAS 1.60:3157) Avail: NTIS HC/MF A04 CSCL 20D

Pressure distributions measured on a 60 degree half-angle elliptic cone, raked off at an angle of 73 degrees from the cone centerline and having an ellipsoid nose (ellipticity equal to 2.0 in the symmetry plane) are presented for angles of attack from -10 degrees to 10 degrees. The high normal shock density ratio aspect of a real gas was simulated by testing in Mach 6 air and CF sub 4 (density ratio equal to 5.25 and 12.0, respectively). The effects of Reynolds number, angle of attack, and normal shock density ratio on these measurements are examined, and comparisons with a three dimensional Euler code known as HALIS are made. A significant effect of density ratio on pressure distributions on the cone section of the configuration was observed; the magnitude of this effect decreased with increasing angle of attack. The effect of Reynolds number on pressure distributions was negligible for forebody pressure distributions, but a measurable effect was noted on base pressures. In general, the HALIS code accurately predicted the measured pressure distributions in air and CF sub 4. Author

N92-20684# Colorado Univ., Boulder.
MATHEMATICAL ANALYSIS OF TRANSIENT REACTIVE GASDYNAMICS PHENOMENA
D. R. Kassoy and J. Bebernes 16 Sep. 1991 16 p
(Contract DAAL03-88-K-0111)
(AD-A244478; ARO-25753.9-MA) Avail: NTIS HC/MF A03 CSCL 20/4

Mathematical modeling and analysis are described for studies of the dynamical response of gaseous and solid materials (inert or reactive) to localized rapid power deposition. Theoretical, analytical, and numerical methods are developed to find general properties of nonlinear equation systems and explicit solutions for specific initial-boundary value problems. Emphasis is placed on physical interpretation of mathematical results for the transient evolution of spatially distributed thermal and gasdynamic responses. New results are given for thermal explosion processes, for transient development of shocks and detonations, for the role of nonlinear acoustics in gas compression, and for thermoacoustically induced mass transfer. GRA

N92-20711# Calspan-Buffalo Univ. Research Center, NY.
NON-EQUILIBRIUM RADIATION FROM SHOCK-HEATED AIR Final Report, 1 Jul. 1988 - 30 Jun. 1991
W. H. Wurster, C. E. Treanor, and M. J. Williams Jul. 1991 94 p
(Contract DAAL03-88-K-0174)
(AD-A244905; ARO-26244.3-EG-SDI) Avail: NTIS HC/MF A05 CSCL 04/1

A research program is described whose objectives include the quantitative measurement of the ultraviolet radiation behind strong shock waves in air, the identification of the radiating species and the determination of the mechanisms and rates that govern the emission. A shock tube was used to generate 3-4 km/s shock waves through air and oxygen nitrogen mixtures at initial pressures between 0.36-2.25 torr. The temporal gas-radiance profiles recorded radiometrically exhibited strong non-equilibrium overshoots, followed by decay to steady-state equilibrium. The dependence of the peak overshoot values on wave speed and pressure was measured and shown to scale with density. Emission spectra of the gas both in the overshoot region and the equilibrium region showed the NO gamma band system between 210 and 340 nm to be the dominant radiation source. The role of O2 Schumann-Runge radiation in this region was also studied; in pure O2 no overshoot was recorded. Infrared vibronic emission profiles were also measured and shown to be a description of the NO concentration growth. It was found that currently accepted rates

for air ground-state chemistry do not predict the NO generation correctly. Finally, a simplified excitation model is suggested to describe the ultraviolet radiation behind the shock wave. GRA

N92-20837# Department of the Navy, Washington, DC.
METERING SYSTEM FOR COMPRESSIBLE FLUIDS Patent Application
David P. Owen, inventor (to Navy), Wayne C. Jones, inventor (to Navy), David E. Johnson, inventor (to Navy), and George V. Nagle, inventor (to Navy) 26 Mar. 1991 20 p
(AD-D015184; US-Patent-Appl-SN-675203) Avail: NTIS HC/MF A03 CSCL 20/4

This patent application discloses an apparatus and method for accurately and efficiently metering at least one compressible fluid and at least one incompressible fluid for mixing, whereby pressure and therefore density is regulated with regard to each compressible fluid, and volume is regulated with regard to each compressible fluid as well as each incompressible fluid. Compressible fluids in particular are metered more accurately because the mass of each fluid is used as the variable measurement standard, both the density and the volume of each fluid being maintained at controlled and predictable levels. Independent regulation of the volume of each fluid, e.g., in terms of flow rate, along with independent regulation of the pressure of each fluid which is a compressible fluid, serve not only to optimize metering accuracy metering efficiency as well by accounting for relative compressibilities and viscosities between or among the fluids, thereby permitting minimization of lag times between or among the flows of the fluids, in this way furthering integration of the individual metering processes of all the fluids into one cooperative system whereby the flows of all the fluids are mutually and/or concurrently controlled. GRA

N92-20862# Naval Postgraduate School, Monterey, CA.
A REAL TIME INTERFEROMETRY SYSTEM FOR UNSTEADY FLOW MEASUREMENTS
N. J. Brock, M. S. Chandrasekhara, and L. W. Carr Oct. 1991 10 p
(Contract MIPR-ARO-114-91)
(AD-A244936; ARO-27894.9-EG) Avail: NTIS HC/MF A02 CSCL 01/1

A simple real-time interferometer system was developed for use in dynamic stall and other unsteady flow research at compressible flow speeds. A conventional schlieren system was modified to operate as a point diffraction interferometer. The implementation of this interferometer is discussed and results of trails with different point diffractors are presented in this paper. The performance of the interferometer under various flow conditions was investigated. Results are presented which show the effects of the interferometer parameters such as pinhole size and pinhole-plate optical density on the performance of the system. GRA

N92-20893# Defence Research Establishment, Ottawa (Ontario).
FILTER CANISTER FLOW DISTRIBUTION VISUALIZATION EXPERIMENTS
P. Meunier, C. Pedersen, and L. Constantine Mar. 1991 25 p
(AD-A244651; DREO-TN-91-17) Avail: NTIS HC/MF A03 CSCL 20/4

A colorimetric method of visualizing the airflow distribution inside a charcoal filter canister was developed. The aim of the experiments carried out with this method was to ensure the adequacy of a new plastic canister design. The method uses silica gel of the same size as the charcoal used in the canister, coated with an acid/base dye which changes color from yellow to a dark blue in the presence of a base. A mixture of air and diethyl amine is passed through the canister and its reaction with the dye causes it to turn blue immediately. A cross section of the silica gel bed shows the transition between the reacted dye and non-reacted dye. The interface line gives an indication of airflow distribution inside the charcoal bed. The contrast obtained between the dye's original color and the reacted color was found to be dependent on the appropriate relative humidity preconditioning of the canister. GRA

N92-20918# Tokyo Univ., Sagamihara (Japan). Inst. of Space and Aeronautical Science.
PROCEEDINGS OF THE SYMPOSIUM ON MECHANICS FOR SPACE FLIGHT 1990
Koichi Oshima, ed. Mar. 1991 97 p Symposium held in Sagamihara, Japan, 29 Nov. - 1 Dec. 1990
(ISAS-SP-13; ISSN-0288-433X) Avail: NTIS HC/MF A05

Papers from the symposium are presented, and their topics include: (1) normal wall effect and the minimum critical Reynolds number for flow in a circular pipe; (2) study of capillary driven flow in a tube; (3) minimax optimization in the time domain; (4) attitude control system of the S-520 recovery type rocket; (5) intensification of phase change heat transfer; and (6) Brayton-Rankin total energy space dynamic power system analysis. For individual titles, see N92-20919 through N92-20924.

N92-20919# Tokyo Univ., Sagamihara (Japan).
NORMAL WALL EFFECT AND THE MINIMUM CRITICAL REYNOLDS NUMBER FOR FLOW IN A CIRCULAR PIPE
Hidesada Kanda *In its* Proceedings of the Symposium on Mechanics for Space Flight 1990 Mar. 1991 p 3-23 (For primary document see N92-20918 11-34)
Avail: NTIS HC/MF A05

The stability of Hagen-Poiseuille flow in the entrance region is studied with particular emphasis on the effect of a smooth wall. It is generally known from boundary-layer theory that the radial pressure distribution is almost constant, and from the Bernoulli equation that the pressure near the wall is higher than that in the central core. However, the results of calculation, computed by solving directly the stream-function vorticity formulation and the Poisson equation, conflict with these findings. We must therefore consider the existence of a normal force that balances the pressure drop. Numerical calculation reveals a paradox and two necessary parameters that determine the transition, and thus we can obtain the minimum critical Reynolds number of 2165 and can also estimate a critical Reynolds number that is consistent with experimental observation. Author

N92-20920# Tokyo Univ., Sagamihara (Japan). Dept. of Applied Physics and Information Science.
STUDY OF CAPILLARY DRIVEN FLOW IN A TUBE
Naoki Ichikawa, Takeshi Nakada, Yoko Satoda, and Masahide Murakami *In its* Proceedings of the Symposium on Mechanics for Space Flight 1990 Mar. 1991 p 25-36 (For primary document see N92-20918 11-34)
Avail: NTIS HC/MF A05

This paper describes the dynamics of liquid in a tube driven by capillary force. The movement of a gas-liquid interface in a horizontal tube as a result of capillary action is experimentally investigated in a microgravity environment onboard an airplane and on the ground. Theoretical analysis of interface dynamics is also presented. Dimensionless numbers representing time and distance scales are introduced to derive a unique functional relation. The experimental results are found to agree with the theoretical result. The dynamic contact angle and the dynamic surface tension are calculated from the small discrepancy between the theoretical and experimental values. The result is compared with the static values. Author

N92-20921# Tokyo Univ., Sagamihara (Japan). Dept. of Aerospace Engineering.
MINIMAX OPTIMIZATION IN THE TIME DOMAIN **c63**
Toshiyuki Ohtsuka and Hironori Fujii *In its* Proceedings of the Symposium on Mechanics for Space Flight 1990 Mar. 1991 p 37-46 (For primary document see N92-20918 11-34)
Avail: NTIS HC/MF A05

A minimax optimization problem is introduced to design terminal controllers for generic dynamical systems without disturbances. The maximum output of the system is minimized over an interval

by the control input with the prescribed maximum amplitude. The settling property of the output can be specified through a transformation of variables. Such important characteristics of the control system appear explicitly in the proposed problem as the maximum amplitude of the output, the maximum amplitude of the control input, and the settling property of the output. Therefore, analytical specification can be obtained to evaluate the controlled response without recourse to numerical simulations. The minimum principle results in the necessary condition for the optimal control input and a two-point boundary layer problem (TPBVP) associated with the minimax optimization. Some analytical features of the TPBVP are discussed, and numerical examples are shown. Author

N92-20922# Tokyo Univ., Sagamihara (Japan).
ATTITUDE CONTROL SYSTEM OF THE RETRIEVAL TYPE ROCKET S-520 **c20**
Ichiro Nakatani, Junichiro Kawaguchi, Rituo Hasegawa, Masaru Abe, and Kazuhiko Ashina (Mitubichi Precision Cc. Ltd., Japan) *In its* Proceedings of the Symposium on Mechanics for Space Flight 1990 Mar. 1991 p 47-52 (For primary document see N92-20918 11-34)
Avail: NTIS HC/MF A05

The retrieval type sounding rocket S-520 was developed by the Institute of Space and Astronautical Science to make possible the recovery (and eventual reuse) of onboard attitude control electronics. The attitude control system and flight results are described. Author

N92-20923# Tokyo Univ., Sagamihara (Japan).
INTENSIFICATION OF PHASE CHANGE HEAT TRANSFER
S. V. Konev *In its* Proceedings of the Symposium on Mechanics for Space Flight 1990 Mar. 1991 p 53-67 (For primary document see N92-20918 11-34)
Avail: NTIS HC/MF A05

Heat and mass transfer phenomena by phase change under the action of capillary forces are examined. The obtained analytical and experimental results are applied to the basic development of unified heat pipes with capillary structures and extended heat transfer systems. Author

N92-20924# Tokyo Univ., Sagamihara (Japan).
BRAYTON-RANKINE TOTAL ENERGY SPACE DYNAMIC POWER SYSTEM ANALYSIS **c44**
Zhi-Guang Ling and Koichi Oshima *In its* Proceedings of the Symposium on Mechanics for Space Flight 1990 Mar. 1991 p 69-80 (For primary document see N92-20918 11-34)
Avail: NTIS HC/MF A05

A study was made on combined Brayton-Rankine total energy space dynamic power system. Thermodynamic analysis and comparative calculation were performed for the system and the regenerative Brayton system. Results show that under space conditions even with water as the working fluid of the Rankine part, the thermal efficiency could be raised by 5 to 10 pct. at working point, in comparison with a regenerative Brayton system and with the existing technology for the Rankine system alone. An increase in steam turbine and pumps in comparison with regenerative Brayton system brought no significant reduction in system weight. Through radiator area analysis, the suggested total energy system shows no significant increase in radiation area. The spray radiator is more suitable for this purpose. Further conceptional projective study is needed to proceed in the optimization of parameters and appropriate working substance together with the spray radiator condenser design considerations. Author

N92-20939# Messerschmitt-Boelkow-Blohm G.m.b.H., Schrobenhausen (Germany, F.R.).
PENETRATION OF SHAPED CHARGE INTO WATER
Manfred Held and Josef E. Backofen (Brigs Co., Herndon, VA.) 1990 13 p Presented at the 12th International Symposium on Ballistics, San Antonio, TX, 30 Oct. - 1 Nov. 1990
(MBB-UA-0324-90-PUB; ETN-92-90994) Avail: NTIS HC/MF A03

The penetration of copper, aluminum, and tantalum shaped charge jets through water was studied and documented by means of high speed photography and both make and break electrical switches. The measurements of water cratering by the jets are described for shaped charges fired in the air at standoff distances of 2 and 6 calibers from the water tank. The velocity distribution and breakup performance of the jets in air at long standoff distance is reported. The data were compared with calculations using a modified virtual origin model of the three jets and with calculations by the BRIGS computer code. Comparison of the data and calculations showed that using the incompressible hydrodynamic formula in both analytical models overpredicts the penetration through water. The compressible model in BRIGS matched the experiment data quite well during penetration by continuous and particulated jets until the net flow within the target became subsonic as a result of the time between jet particle impacts. At this point, the accumulated target material motion has a significant penetration process effect which was recorded by the instrumentation. ESA

N92-20979# Rensselaer Polytechnic Inst., Troy, NY.
AN EXPERIMENTAL STUDY OF PLUNGING LIQUID JET INDUCED AIR CARRYUNDER AND DISPERSION Quarterly Report No. 4
F. Bonetto and R. T. Lahey, Jr. 24 Dec. 1991 29 p
(Contract N00014-91-J-1271)
(AD-A244512) Avail: NTIS HC/MF A03 CSCL 20/4

A good understanding of the air carryunder and bubble dispersion process associated with a plunging liquid jet is vital if one is to be able to quantify such diverse phenomena as the environmental impact of power plant discharges, sea surface chemistry, the meteorological significance of (breaking) ocean waves, the performance of certain types of chemical reactors, the 'greenhouse' effect (ie, the absorption of CO2 by the oceans), and a number of other important maritime-related applications. In particular, the air entrainment process due to the breaking bow waves of surface ships may cause long (ie, up to 5 km in length) wakes. Naturally, easily detectable wakes are undesirable for naval warships. In the present study, plunging liquid jet experiments were performed, and detailed Laser Doppler Anemometer (LDA) data were taken of the phasic velocity field and the void fraction distribution in the induced two-phase jet. GRA

N92-21000# University of Southern California, Los Angeles. Dept. of Chemical Engineering.
A THEORETICAL ANALYSIS OF VERTICAL FLOW EQUILIBRIUM
Y. C. Yortsos Jan. 1992 30 p
(Contract DE-FG22-90BC-14600)
(DE92-001018; DOE/BC-14600/17) Avail: NTIS HC/MF A03

The assumption of vertical flow equilibrium (VFE) and of parallel flow conditions, in general, is often applied to the modeling of flow and displacement in natural porous media. However, the methodology for the development of the various models is rather intuitive, and no rigorous method is currently available. We develop an asymptotic theory using as parameter the variable R(sub L) = (L/H) sq root of (k(sub V))/(k(sub H)). It is rigorously shown that present models represent the leading order term of an asymptotic expansion with respect to 1/(R(sub L)(exp 2)). Although this was numerically suspected, it is the first time that it is theoretically proven. Based on the general formulation, a series of models are subsequently obtained. In the absence of strong gravity effects, they generalize previous works by Zapata and Lake (1981), Yokoyama and Lake (1981), and Lake and Hirasaki (1981) on immiscible and miscible displacements. In the limit of gravity-segregated flow, we prove conditions for the fluids to be segregated and derive the Dupuit and Dietz (1953) approximations. Finally, we also discuss effects of capillarity and transverse dispersion. DOE

N92-21007# Lawrence Livermore National Lab., CA.
SHOCK INTERACTIONS WITH A DENSE-GAS WALL LAYER

A. L. Kuhl, H. Reichenbach, and R. E. Ferguson (Naval Surface Warfare Center, Silver Spring, MD.) 19 Nov. 1991 12 p Presented at the 18th International Symposium on Shock Waves, Sendai (Japan), 21-26 Jul. 1991
(Contract W-7405-eng-48)
(DE92-007337; UCRL-JC-107191; CONF-9107138-5) Avail: NTIS HC/MF A03

Experiments and calculations of the interaction of a planar shock with a dense-gas layer located on the floor of the shock tube test section are described. The shock front deposited vorticity in the layer by the baroclynic mechanism. The wall shear layer was unstable and rapidly evolved into a turbulent boundary layer with a wide spectrum of mixing scales. Density effects dominated the dynamics in the wall region. DOE

N92-21048# City Coll. of the City Univ. of New York, NY. Inst. of Applied Physicochemical Hydrodynamics.
COMPARATIVE STUDY OF THE VORTICITY FIELD IN TURBULENT FLOWS: THEORY, EXPERIMENTS, COMPUTATIONS
E. Levich Sep. 1991 5 p
(Contract DE-FG02-88ER-13837)
(DE92-003042; DOE/ER-13837/1) Avail: NTIS HC/MF A01

The goal of the project was to understand the role of topology vortex lines in general and the helicity invariant (inviscid) in particular for turbulent dynamics. The project consisted of three main ingredients: theoretical, numerical and experimental. The achievements and failures of the above are separately reported in this paper. DOE

N92-21050# Institute of Gas Technology, Chicago, IL.
DETERMINATION OF FLOW-REGIME BOUNDARIES FOR COHESIVE PARTICLES
T. M. Knowlton and J. G. Findlay Oct. 1991 62 p
(Contract DE-AC22-88PC-88951)
(DE92-003081; DOE/PC-88951/9) Avail: NTIS HC/MF A04

The overall objective of this program is the development of a hydrodynamic model to predict the choking/non-choking flow regime boundary of fine, cohesive (that is, Geldart Group C) powders. Specific objectives are to: (1) develop a two-dimensional hydrodynamic model that can be applied to cohesive solids; and (2) generate large-scale solids-flow data that will be used to verify the model. DOE

35 INSTRUMENTATION AND PHOTOGRAPHY

Includes remote sensors; measuring instruments and gages; detectors; cameras and photographic supplies; and holography.

For aerial photography see *43 Earth Resources and Remote Sensing.* For related information see also *06 Aircraft Instrumentation,* and *19 Spacecraft Instrumentation.*

N92-20141# Oak Ridge National Lab., TN.
EVALUATION OF THE SELF-CALIBRATING THERMOCOUPLE AS A FRONT END TO A SMART TEMPERATURE MEASUREMENT SYSTEM
F. R. Ruppel 1991 27 p Presented at the 7th International Symposium on Temperature: Its Measurement and Control in Science and Industry, Toronto, 28 Apr. - 1 May 1992
(Contract DE-AC05-84OR-21400)
(DE92-002315; CONF-920423-1) Avail: NTIS HC/MF A03

An evaluation of the novel self-calibrating thermocouple was performed to determine whether the sensor would be acceptable as a front end to a smart temperature measurement system. The evaluation consisted of a fast-ramp test, long-term drift tests, and physical examinations including X rays, microphotography, and energy-dispersive spectrometry. The results of the tests show that the sensor is a viable industrial-grade device worthy for use in this application. However, recommendations for improving fabrication of the assembly are made and caveats are given for conditions that may constrain the use of the sensor in certain situations. DOE

N92-20203# Sandia National Labs., Albuquerque, NM.
SCANNING ELECTRON MICROSCOPY TECHNIQUES
E. I. Cole, Jr. 1992 36 p Presented at the IEEE International Reliability Physics Symposium, San Diego, CA, 30 Mar. - 2 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-006821; SAND-92-0143C; CONF-920327-3) Avail: NTIS HC/MF A03

The scanning electron microscope (SEM) has become as standard a tool for IC failure analysis as the optical microscope, with improvements in existing SEM techniques and new techniques being reported regularly. This tutorial has been designed to benefit both novice and experienced failure analysts by reviewing several standard as well as new SEM techniques used for failure analysis. Advanced electron-beam test systems will be covered briefly; however all techniques discussed may be performed on any standard SEM. Topics to be covered are (1) standard techniques: secondary electron imaging for surface topology, voltage contrast, capacitive coupling voltage contrast, backscattered electron imaging, electron beam induced current imaging, and x-ray microanalysis; and (2) new SEM techniques: novel voltage contrast applications, resistive contrast imaging, biased resistive contrast imaging, and charge-induced voltage alteration. Each technique will be described in terms of the information yielded, the physics behind technique use, any special equipment and/or instrumentation required to implement the technique, the expertise required to implement the technique, possible damage to the IC as a result of using the technique, and examples of using the technique for failure analysis. DOE

N92-20208# National Inst. of Standards and Technology, Gaithersburg, MD. Manufacturing Engineering Lab.
A CLOCK FOR THE MANUFACTURING SYSTEMS INTEGRATION TESTBED
Don Libes 5 Sep. 1991 19 p Sponsored in part by Dept. of the Navy
(PB92-108885; NISTIR-4666) Avail: NTIS HC/MF A03 CSCL 14B

Described here is a software module that provides timing services to the Manufacturing Systems Integration (MSI) testbed in the automated factory. The software 'alarm clock' provides services to other MSI software, including synchrony; real time, or non-real time adjusted in a variety of ways; and alarms at relative or absolute intervals. By providing a central time service, these services are provided more reliably, efficiently, and flexibly than any client could provide on his own. Described are the implementation, the interfaces, and how to design and write programs that use MSI. Author

N92-20227# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Light Structures.
INSTRUMENTED DROP WEIGHT IMPACT TESTER
Z. Tao, J. Laitila, and O. Saarela 1991 21 p
(PB92-127455; Rept-91-B23; ISBN-951-22-0751-6) Avail: NTIS HC/MF A03 CSCL 14B

Test equipment for determining the contact force and dynamic response of a composite laminate under impact is described. The equipment is based on the falling weight setup. The measurement system consists of a dynamic force transducer placed in the front part of an impactor, a charge amplifier, strain gauges, DC measuring amplifiers, and a digital storage oscilloscope which is connected to a microcomputer via a GBIB-interface. The force transducer is designed for a maximum load of 5 kN in compression and for a frequency range of 100 Hz to 50 kHz. The strains of the laminate are measured with strain gages which are mounted on the surface of the laminate. Strain and force signals are recorded by the digital storage oscilloscope through a strain amplifier and an electric charge amplifier, respectively. The force transducer is calibrated dynamically with a standard force transducer. GRA

N92-20248# Rolls-Royce Ltd., Derby (England).
PHASE-STEPPING PULSED HOLOGRAPHY FOR VIBRATION ANALYSIS: A NUMERICAL SIMULATION AND THE APPLICATION OF THE TECHNIQUE IN AN INDUSTRIAL ENVIRONMENT
V. B. McKee and R. J. Parker 1 Oct. 1990 4 p Presented at Applied Optics and Opto-Electronics, Nottingham, England, 17-20 Sep. 1990
(PNR-90855; ETN-92-90849) Copyright Avail: NTIS HC/MF A01

Results of a numerical simulation of the phase stepping process used with stroboscopic/pulsed holography and/or multiple reference beams is illustrated. A typical result from the simulation is illustrated. The simulation work addresses some of the errors which could be present in a real optical system. Such errors include hologram plate repositioning errors, and wavefront recreation errors. The simulation has been used in the development of a number of industrial procedures. The industrial application of the phase stepping process and some of the measures necessary to make it workable as a standard tool for vibration analysis are discussed. ESA

N92-20282*# Stanford Univ., CA. Center for Space Science and Astrophysics.
THE DEVELOPMENT AND TEST OF A DEFORMABLE DIFFRACTION GRATING FOR A STIGMATIC EUV SPECTROHELIOMETER Final Report
J. Gethyn Timothy, A. B. C. Walker, Jr., J. S. Morgan, M. C. E. Huber, and G. Tondello (Padua Univ., Italy) 14 Mar. 1992 109 p Original contains color illustrations
(Grant NAGw-540)
(NASA-CR-190128; NAS 1.26:190128) Avail: NTIS HC/MF A06; 1 functional color page CSCL 14B

The objectives were to address currently unanswered fundamental questions concerning the fine scale structure of the chromosphere, transition region, and corona. The unique characteristics of the spectroheliometer was used in combination with plasma diagnostic techniques to study the temperature, density, and velocity structures of specific features in the solar outer atmosphere. A unified understanding was sought of the interplay between the time dependent geometry of the magnetic field structure and the associated flows of mass and energy, the key to which lies in the smallest spatial scales that are unobservable with current EUV instruments. Toroidal diffraction gratings were fabricated and tested by a new technique using an elastically deformable substrate. The toroidal diffraction gratings was procured and tested to be used for the evaluation of the Multi-Anode Microchannel Array (MAMA) detector systems for the Solar Ultraviolet Measurements of Emitted Radiation (SUMER) and UV Coronagraph Spectrometer (UVCS) instruments on the SOHO mission. Author

N92-20491# Rolls-Royce Ltd., Derby (England). Optical Sciences Group.
HOLOGRAPHIC FLOW VISUALIZATION IN ROTATING TURBOMACHINERY
R. J. Parker and M. Reeves 1 Nov. 1990 9 p Sponsored by Ministry of Defence
(PNR-90837; ETN-92-90791) Copyright Avail: NTIS HC/MF A02

Holographic flow visualization has found many applications in rotating turbomachinery. Applications in the design of aeroengine fans, automotive turbochargers, turbines, helicopter rotors, and advanced propfans are discussed. Work in ducted rotating flows and rotating free aerofoils is brought together and new developments in each field are revealed. ESA

N92-20575# Rolls-Royce Ltd., Derby (England).
HOLOGRAPHIC VISUALIZATION OF HYPERVELOCITY EXPLOSIVE EVENTS
I. C. Cullis, R. J. Parker, and D. Sewell (Hunting Engineering Ltd., Porton Down, England) 1 Jan. 1991 14 p Sponsored in part by Ministry of Defence and Hunting Engineering Ltd.
(PNR-90850; ETN-92-90800) Copyright Avail: NTIS HC/MF A03

A pulsed ruby laser and specially constructed 'holocamera' were used to produce three dimensional, holographic images of explosively formed hypervelocity projectiles in flight. Velocities of the projectiles studied were up to 6500 m/s. Using this holographic technique it was possible to study interaction of these projectiles with solid targets and even the effects of detonation under water. The hologram proved particularly useful in the study of jets of low density materials which were transparent to X ray techniques. ESA

N92-20651# National Inst. of Standards and Technology, Gaithersburg, MD. Technology Services.
A PROCEDURE FOR THE EFFECTIVE RECALIBRATION OF LIQUID-IN-GLASS THERMOMETERS Final Report
Jacquelyn A. Wise Aug. 1991 19 p
(PB92-109024; NIST/SP-819) Avail: NTIS HC/MF A03; also available SOD HC $1.50 as 003-003-03102-0 CSCL 14B

High quality, liquid-in-glass thermometers require only one complete calibration in their lifetime. It is also possible to avoid the usual complete recalibration of the instrument by recalibrating a single previously calibrated temperature. The need for recalibration of properly manufactured liquid-in-glass thermometers is due to the gradual relaxation of residual mechanical strains in the glass that have a significant effect on the volume of the bulb. The recalibration of a single point provides a reliable indication of the effect of this change in volume and provides a means for the accurate adjustment of the remainder of the scale. The paper describes a procedure for the single temperature recalibration of liquid-in-glass thermometers. The procedure and the subsequent adjustment of the entire scale can be performed in the user's laboratory. The adjustment of the scale that is required by the recent introduction of the new International Temperature Scale (ITS-90) is also described. GRA

N92-20692# Lightwave Electronics Corp., Mountain View, CA.
INTERFEROMETRIC OPTICAL HIGH PRESSURE SENSOR Final Report
Thomas R. Steele Jan. 1992 66 p
(Contract DAAA15-88-C-0053)
(AD-A245100; BRL-CR-681) Avail: NTIS HC/MF A04 CSCL 14/2

A high pressure sensor has been built and tested based on measuring the compression of an optical etalon and recording the resulting fringe shifts. A birefringent sapphire etalon has been used along with polarized light to make the etalon function as a dual-thickness device; the result is to remove the ambiguity of direction of pressure change that results from a single etalon device. Details of the pressure head design, pressure sealing, and system evaluation are presented. Design goals of better than 5,000 psi accuracy over a range up to 150,000 psi with time resolution better than 0.1 ms are projected to be met from preliminary tests. GRA

N92-20843# Applied Computing Enterprises, Nepean (Ontario).
MODELLING OF PIEZOELECTRIC BEHAVIOUR FOR ACTUATOR AND SENSOR APPLICATIONS
Anthony Faria Vaz 25 Feb. 1991 40 p Sponsored by Canadian Space Agency
(ACE-R-CSA-91-2-0; CSA-DSM-CR-91-005; CTN-92-60416)
Avail: NTIS HC/MF A03

A significant amount of research has shown that piezoelectric sensors and actuators can be used successfully to damp vibrations in large flexible space structures. In this report, the equations used to characterize the behavior of piezoelectric materials are developed. The equations are then used to develop electro mechanical models of piezoelectric actuator and sensor operations. The physics associated with the piezoelectric phenomena is explained and the relevant background in electro magnetics, mechanics of solids, and thermodynamics is briefly summarized. Electro magnetic models of piezoelectric sensor and actuator

behavior are derived. The mechanical aspect of these models permits the analysis of the dynamics of the interactions between the structural members and piezoelectric elements. The electrical aspects of the models are required for determining appropriate interface electronics. The physical properties of piezoelectric materials that determine their suitability for use as a sensor or an actuator were determined. It was determined that poly vinylidene fluoride (PVDF) sensors are more sensitive than piezoceramic sensors. On the other hand, piezoceramic actuators are more efficient than PVDF actuators. Appropriate interface electronics for piezoelectric sensors and actuators are specified. CISTI

N92-20968# Defence Research Establishment, Ottawa (Ontario).
TWO COMPACT TANDEM ARCHITECTURES FOR THE IMPLEMENTATION OF TIME-INTEGRATING CORRELATORS
N. Brousseau and J. W. Salt Jul. 1991 26 p In ENGLISH; FRENCH summary
(AD-A245178; DREO-TN-91-8) Avail: NTIS HC/MF A03
CSCL 09/5

This technical note presents two new ways to build time-integrating correlators. The new methods are characterized by a tandem configuration of the Bragg cells that produces an almost common path for the interfering beams. It is also characterized by simplified, smaller illumination systems. In the first method, the illumination system consists of a beam-splitting cube used in an unconventional way. A hologram is used to illuminate the second system. In both cases, important reduction in the size and complexity of the systems is achieved. Results from the operation of both systems are presented. GRA

N92-20984# Alabama A & M Univ., Normal.
PARAMETRIC INVESTIGATION OF HOLOGRAPHIC GRATING AND OPTICAL PHASE CONJUGATION THROUGH DEGENERATE FOUR WAVE MIXING IN SATURABLE ABSORPTIVE/RESONANT/NONRESONANT SYSTEMS Final Report
Putcha Venkateswarlu 26 Nov. 1991 53 p
(Contract DAAL03-87-G-0078)
(AD-A244536; ARO-24138.4-PH-H) Avail: NTIS HC/MF A04
CSCL 20/6

Parametric investigation of volume holographic gratings and optical phase conjugation are studied through coherent and incoherent beam couplings in barium titanate (BaTiO3) and through the study of bistability in phase conjugate resonators. Experiments have been done on the effect of color centers in the formation of resonant systems and holographic grating formation. A summary of the important results appears in the final report. GRA

N92-20997# Environmental Research Inst. of Michigan, Ann Arbor. Advanced Concepts Div.
CONCEPT DESIGN PHASE EXPENDABLE HOLOGRAPHIC SENSOR TO MEASURE OCEAN SMALL ANGLE OPTICAL SCATTERING Final Report
Fred J. Tanis 1 Jul. 1991 58 p
(Contract N00012-90-C-0091)
(AD-A245067; ERIM-227000-1-F) Avail: NTIS HC/MF A04
CSCL 20/6

A preliminary design concept has been developed for a holographic instrument to measure scattering and beam transmission optical properties of ocean waters. The expandable instrument is being developed for use with ship or aircraft deployment using the XDT/AXBT technology. The instrument design has been separated into four measurement functions: (1) beam transmission; (2) small angle scattering; (3) large angle scattering; and (4) backscatter. The present research has focussed on developing and demonstrating a holographic design to measure small angle scattering. This instrument measures the modulation transfer function (MTF) of the particles suspended in the water. The MTF can be inverted with a Fourier-Bessel transform procedure to estimate the volume scattering function at small angles. A laboratory demonstration hologram was constructed to focus a sinusoidal pattern scattered by polystyrene spheres onto a linear detector array. The laboratory results showed loss of contrast with increasing spatial frequency. Simulation model results for a 25 cm instrument demonstrated the capability to measure contrast loss at selected spatial frequencies and used that information to derive the volume scattering function for angles from 0.005 to 0.5 deg. Author (GRA)

N92-21005# Michigan Univ., Ann Arbor. Dept. of Physics.
DEVELOPMENT AND APPLICATIONS OF THE POSITRON MICROSCOPE
1991 9 p
(Contract DE-FG02-90ER-12103)
(DE92-006535; DOE/ER-12103/2) Avail: NTIS HC/MF A02

Progress on the positron microscope during the past year has been steady, and we currently project that initial microscope images can be collected during mid to late summer of 1992. Work during the year has mainly been divided among four areas of effort: hardware construction; power supply and control system development; radioactive source fabrication; and planning of initial experimental projects. Details of progress in these areas will be given below. An initial optical design of the microscope was completed during 1990, but during the past year, significant improvements have been made to this design, and several limiting cases of microscope performance have been evaluated. The results of these evaluations have been extremely encouraging, giving us strong indications that the optical performance of the microscope will be better than originally anticipated. In particular, we should be able to explore ultimate performance capabilities of positron microscopy using our currently planned optical system, with improvements only in the image detector system, and the positron-source/moderator configuration. We should be able to study imaging reemission microscopy with resolutions approaching 10 A and be able to produce beam spots for rastered microscope work with diameters below the 1000 A diffusion limit. Because of these exciting new possibilities, we have decided to upgrade several microscope subsystems to levels consistent with ultimate performance earlier in our construction schedule than we had previously intended. In particular, alignment facilities in the optical system, vibration isolation, and power supply and control system flexibility have all been upgraded in their design over the past year. DOE

36 LASERS AND MASERS

Includes parametric amplifiers.
For related information see also *76 Solid-State Physics.*

N92-20059# Pacific Northwest Lab., Richland, WA.
LASER-INDUCED FLUORESCENCE IN DOPED METAL OXIDE PLANAR WAVEGUIDES DEPOSITED FROM AQUEOUS SOLUTIONS
N. J. Hess, G. J. Exarhos, and S. M. Wood (Washington State Univ., Pullman.) Dec. 1991 7 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contracts DE-AC06-76RL-01830; DE-AM06-70RL-02225)
(DE92-006513; PNL-SA-19744; CONF-911202-38) Avail: NTIS HC/MF A02

An aqueous route to the deposition of complex metal oxide films is based upon the complexation of the corresponding metal nitrate salts by glycine, followed by spin-casting the concentrated solution onto silica substrates. The presence of glycine serves to frustrate precipitation and leads to the formation of a glassy matrix through which metal cations are homogeneously dispersed. Subsequent heating of coated substrates initiates an oxidation-reduction reaction which removes the organic matrix and residual nitrate leaving behind a film of the desired oxide composition. Using this method, ruby (Cr:Al2O3) and Sm:YAG (Sm:Y3Al5O12) films on the order of 150 nm thick have been deposited. The respective phase have been confirmed by XRD data and from the measured fluorescence spectra. The red fluorescence exhibited by these materials under 488 nm excitation

is dependent upon the ambient temperature and pressure. A marked shift in wavelength is observed as a function of increasing pressure. Ruby also exhibits a temperature dependent wavelength shift in contrast to Sm:YAG where a negligible shift is seen to temperatures near 1200 K. Fluorescence lifetimes of both materials exhibit a temperature dependence which varies with dopant concentration. This work suggests the possible application of these films as pressure-temperature sensors in a planar waveguide configuration or as a coating material for optical fibers. Details of the deposition process will be reviewed and the fluorescence response of both types of films will be summarized. DOE

N92-20090# Lawrence Livermore National Lab., CA.
TYPE 2/TYPE 2 THIRD-HARMONIC GENERATION IN KDP AT HIGH FLUENCES IN A 3-cm APERTURE
P. Wegner, M. Henesian, M. Kozlowski, and T. Weiland 25 Jul. 1991 37 p
(Contract W-7405-eng-48)
(DE92-007275; UCRL-ID-108672) Avail: NTIS HC/MF A03

We have tested high-threshold KDP in a type II/type II polarization mismatch THG configuration at fluences and intensities in a 3-cm aperture which approach Nova Upgrade levels. The purpose of this work was to demonstrate high efficiency, damage-free third-harmonic generation in the proposed Upgrade operating regime of 9 to 12 J/cm(exp 2) at a 3-ns pulse duration. DOE

N92-20116# Massachusetts Inst. of Tech., Cambridge. Plasma Fusion Center.
GYROTRON ELECTROMAGNETIC WIGGLER FOR A COMPACT FREE ELECTRON LASER
R. Temkin Jan. 1992 11 p
(Contract DE-AC03-86SF-16498)
(DE92-005545; DOE/SF-16498/T1) Avail: NTIS HC/MF A03

We have demonstrated a novel, high power (greater than or = 1 MW), short wavelength (2 mm) gyrotron electromagnetic (GEM) wiggler for use in a compact free electron laser (FEL). The gyrotron consisted of an electron gun and resonator section followed by a special high Q cavity for storing the power created in the gyrotron resonator. The electromagnetic field stored in the high Q cavity would then be appropriate for use as a wiggler field in an infrared or visible FEL with a moderate energy (4 to 10 MeV) electron beam. The gyrotron experiment tested the practical limits due to ohmic loss, mode conversion, etc. on the strength of such a stored field. It also tested the effect of strong feedback from the high Q cavity back onto the gyrotron resonator. The proposed research utilized the technology of high power, high frequency gyrotrons developed at M.I.T. as part of the Department of Energy program on development of sources for plasma heating. DOE

N92-20173# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
INVESTIGATIONS OF AMPLIFICATION BEHAVIOR OF PULSED SOLID BODY-HIGH POWER LASER SYSTEMS, FROM THE PARTICULAR POINT OF VIEW OF BROADBAND RADIATION Ph.D. Thesis [UNTERSUCHUNGEN ZUM VERSTAERKUNGSVERHALTEN VON GEPULSTEN FESTKOERPER-HOCHLEISTUNGSLASERSYSTEMEN UNTER BESONDERER BERUECKSICHTIGUNG BREITBANDIGER STRAHLUNG]
Ingo Will 1991 138 p In GERMAN
(ETN-92-91151) Avail: NTIS HC/MF A07

It is shown how the amplification parameters of pulsed neodymium glass high power laser systems depend on the wavelength and bandwidth of the input pulse emitted by master oscillators. The correlations between the spectral properties and the temporal characteristics of the pulse are reported and the modifications of both parameter classes occurring during the amplification process are explained. The dependency of the amplification parameter was experimentally examined by laser system. A special master oscillator was developed with variable wavelength and strong variable bandwidth of the emitted radiation. The temporal understructure in the oscillator pulse was considered using a streak camera. A program package for the computation of the wavelength in laser systems was developed for the interpretation of the results. ESA

N92-20290# Los Alamos National Lab., NM.
BROADBAND TUNING OF THE LOS ALAMOS FREE-ELECTRON LASER AND POTENTIAL APPLICATIONS
A. H. Lumpkin and J. C. Goldstein 1991 12 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract W-7405-eng-36)
(DE92-005013; LA-UR-91-3898; CONF-9108118-44) Avail: NTIS HC/MF A03

We examine the prospects for broadband wavelength tuning on the two new free electron lasers (FELS) presently under construction at Los Alamos: the APLE prototype experiment (APWX) (formerly known as HIBAF) and the Advanced FEL (AFEL). Both of these devices are driven by photoelectric injectors, and both facilities should operate initially in the 3 to 5 micron range. We present results of theoretical studies of extended tuning ranges for these facilities. We also briefly discuss the feasibility of using the light from these devices to carry out applications experiments such as DNA spectroscopy, photospallation, and band-gap measurements in solids. DOE

N92-20291# Los Alamos National Lab., NM.
ADVANCED DIAGNOSTIC CONCEPTS FOR EMERGING RF-FEL DESIGNS
A. H. Lumpkin 1991 18 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract W-7405-eng-36)
(DE92-005014; LA-UR-91-3897; CONF-9108118-43) Avail: NTIS HC/MF A03

Adaptations and developments of diagnostic/experimental techniques for emerging Los Alamos designs for RF-linac driven free electron lasers (FELS) are described. Our next FELS are to lase at shorter wavelengths and/or to be more compact than our present infrared FELS. Adjustments to be techniques include spatial compactness, lower emittance regimes, and submicropulse measurement capability. The spatial compactness of the profile monitor reduces shadowing of the injected drive laser and is also applicable to smaller-gap wigglers. The submicropulse measurements include potential slice emittance measurements and recent demonstrated phase effects in drive lasers and e-beams during the macropulse. DOE

N92-20293# Los Alamos National Lab., NM.
FIRST DUAL-SWEEP STREAK CAMERA MEASUREMENTS OF A PHOTOELECTRIC INJECTOR DRIVE LASER
A. H. Lumpkin and J. W. Early 1991 20 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract W-7405-eng-36)
(DE92-005015; LA-UR-91-3896; CONF-9108118-42) Avail: NTIS HC/MF A03

We have performed the first dual-sweep streak camera measurements of a photoelectric injector (PEI) drive laser in regard to micropulse duration, phase jitter, and phase slew. As the drive laser features are directly coupled to eventual electron beam properties, characterization of those features is critical to optimizing free electron laser (FEL) performance. The features have been investigated on both inter- and intramacropulse regimes at the Los Alamos FEL facility. In this initial phase we measured the doubled frequency component from the Nd:YLF based laser system using a Hamamatsu C1587 universal streak camera with a synchroscan plug-in and the dual sweep upgrade unit. We demonstrated macropulse-to-macropulse jitter was approx. 8 ps (RMS) without laser phase stabilization and less than or = 2 ps (RMS) with laser optimization and phase stabilization. Additionally, for the 100 microsec long macropulse the phase slew within the macropulse was reduced with phase feedback from approx. 5 ps to near the resolution limit (less than 2 ps). DOE

N92-20323 California Inst. of Tech., Pasadena.
INVESTIGATIONS OF SEMICONDUCTOR LASER MODULATION DYNAMICS AND FIELD FLUCTUATIONS Ph.D. Thesis
Michael Avery Newkirk 1991 191 p
Avail: Univ. Microfilms Order No. DA9137274

Active-layer photomixing is an optical modulation technique to probe the fundamental modulation response of a semiconductor laser. By heterodyning two laser sources with a tunable frequency difference in the device's active region, the gain, and hence the optical output, is modulated at the beat frequency of the sources. Using an equivalent circuit model for the laser diode, the optical modulation is shown to be decoupled from the electrical parasitics of the laser structure. The fundamental modulation response of the laser can thereby be studied independently of the parasitic response, which would otherwise mask the fundamental response. The photomixing technique is used on GaAs/GaAlAs lasers at room temperature, liquid nitrogen and liquid helium temperature, and it is verified that the modulation response appears ideal to millimeter wave frequencies. Application of the active-layer photomixing technique led to the discovery and explanation of a new effect called the 'gain lever.' It enhances the modulation efficiency of a semiconductor laser with a quantum well active layer. The fundamental coupling between intensity noise and phase noise in semiconductor laser light is investigated. By the technique of 'amplitude-phase decorrelation', the intensity noise can be passively reduced. Using a Michelson interferometer as a frequency discriminator, intensity noise from a distributed feedback (DFB) laser is reduced below its intrinsic level up to a factor of 28. A balanced homodyne detection scheme is used to study the noise reduction in relation to the photon shot noise floor. The balanced detector is also used in experiments with a distributed Bragg reflector (DBR) laser which show that the RIN at high power is only 0.6 dB above the quantum-limited shot noise floor.
Dissert. Abstr.

N92-20359 Columbia Univ., New York, NY.
QUANTUM EFFECTS IN THE FREE ELECTRON LASER AND DIVERGENCES IN HANNAY'S ANGLE Ph.D. Thesis
Ivan Milutin Gjaja 1990 158 p
Avail: Univ. Microfilms Order No. DA9127858

A quantum mechanical formulation of the free electron laser based on the reduction of the Dirac Hamiltonian in the lab frame is proposed. The present theory has an exact analogue in corrected classical equations. The formalism created is used to study the statistical properties of free electron laser radiation and, in particular, the possibility of generating squeezed states. It is demonstrated that under experimentally realizable initial conditions for the electrons and the photons, the free electron laser cannot produce radiation in a squeezed state. It is then shown, by computing the effective density matrix for the radiation field, that the field is a superposition of a coherent state and a chaotic state, with the width of the distribution determined by the initial fluctuations of the electron beam. A study is also made of high order corrections to Hannay's angle for small, but finite values of the adiabatic parameter. A classical analogue is obtained for Berry's nonperturbative scheme of adiabatic iteration, which is then compared to the Lie version of adiabatic perturbation theory. Both approaches show a divergence. Dissert. Abstr.

N92-20369 Texas Univ., Dallas.
FLOW-FIELD THEORY OF LASER-PULSE SELF-FOCUSING Ph.D. Thesis
Kang-Min Hsia 1991 231 p
Avail: Univ. Microfilms Order No. DA9135512

A flow-field method to study the propagation of intense laser pulses in nonlinear media through the self-focal point, including saturation and nonlinear absorption, is presented. A set of coupled quasi-linear hyperbolic equations is used to describe the propagation of light pulses in the self-focusing region. Numerical modeling is based on an analogy with hydrodynamics and is coded by using a finite-difference implementation of the method of characteristics. The computational grid density is determined by the rate of transverse variation of the field wavefront and the spatial redistribution of intensity to avoid the problems of severe singularities and discontinuities that have heretofore prevented a description of the whole process of self-focusing. The new method describes the transverse energy flow, pulse breakup, and other properties of the laser pulse produced by the distortion of the field's phase profile. An asymmetrical focusing structure in three spatial coordinates and one temporal coordinate results from the computations. Pulse-width self-compression and shifting of the peak of the wave-field envelope are verified in the transient case. The filamentary structure of circularly symmetric multimode self-focusing is also studied. The formation and evolution of off-axis focusing filaments causes stratified self-focusing, collapse of energy at the off-axis locations, and central compression. The number and positions of focusing filaments depend directly on the multimode configuration of the incident field. Dissert. Abstr.

N92-20370 Essex Univ., Colchester (England).
FILAMENTATION OF LASER LIGHT IN LASER-PRODUCED PLASMAS Ph.D. Thesis
Serajeddin Hamidi 1991 213 p
Avail: Univ. Microfilms Order No. BRD-93974

Filamentation of laser light in laser-produced plasmas has been studied via a series of experiments using the Essex High Power Laser System. Thin metallic freestanding foil targets were irradiated by laser pulses of 2-5 ns at intensities on the order of 10(exp 13) to 10(exp 14) W cm(exp -2). Various time-integrated and time-resolved diagnostics were utilized and a wide range of results were obtained. The major task of the experiments was the imaging of the rear surface of the target foil into the recording cameras with appropriate spatial and temporal resolutions. The time-integrated results presented comprise the image of the rear surface of the target foils and side on second harmonic shadowgrams and interferograms. From these results, clear evidence for the formation of filaments was obtained. Time-resolved results revealed several features of filamentation. A pulsation in the light transmitted through the target was observed in all streak camera records. It was concluded that these pulsations are a result of the self-focusing of the whole laser beam followed by diffraction leading to a repeated foci behavior. An unexpected and anomalous transmission of laser light through the target foil was observed and was concluded to be a result of the target preheating by a long low-level prepulse which makes the target foil transparent during the early stages of the laser pulse. Wherever appropriate, the results were compared with predictions from the hydrodynamic code (MEDUSA) and with the results of other workers. Dissert. Abstr.

N92-20412# Brookhaven National Lab., Upton, NY.
ADVANCES IN HIGH REPETITION RATE, ULTRA-SHORT, GIGAWATT LASER SYSTEMS FOR TIME-RESOLVED SPECTROSCOPY
L. F. DiMauro 1991 12 p Presented at the OE/LASE '91 4th Society of Photo-Optical Instrumentation Engineers (SPIE) International Symposium, Los Angeles, CA, 20-25 Jan. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005047; BNL-47050; CONF-910123-36) Avail: NTIS HC/MF A03

The objective of this article is to emphasize the current advances in the development of high repetition rate amplifier pumps. Although this review highlights amplifier pump development, any recent data from achieved outputs via the tunable amplifier section is also discussed. The first section describes desirable parameters attributable to the pump amplifier while the rest of the article deals with specific examples for various options. The pump amplifiers can be characterized into two distinct classes: those achieving operation in the hundred hertz regime and those performing at repetition rates greater than or = 1 kHz. DOE

N92-20433# Nauchno-Issledovatelskii Inst. Ehlekt- Rofizicheskoj Apparatury, Leningrad (USSR).
DESIGN OF AN EXIMER LASER CHANNEL FOR LASER FUSION

V. Yu. Baranov, V. A. Burtsev, and M. A. Vasilevskij 1990 28 p In RUSSIAN; ENGLISH summary
(DE92-608686; NIIEFA-P-K-0859) Avail: NTIS HC/MF A03

The results of the research and development associated with a series of KrF-laser devices, for laser fusion, are presented. These lasers were designed for 100 kJ channel operation. Temporal compression of the laser pulses to a value of tau approximately equal to 3-5 ns is suggested. It is recommended that the compression scheme use both stacker and SBS compression. The optical circuits and layout schemes have been developed. Additionally, the main parameters of the ETNA-1 (laser output approximately equal to 10 kJ) and ETNA-2 (laser output approximately equal to 40 kJ) facilities were calculated. DOE

N92-20510# Sandia National Labs., Albuquerque, NM.
BOLT BEAM PROPAGATION ANALYSIS
I. R. Shokair 1991 6 p Presented at the Charged Particle Beam Conference, Silver Springs, MD, 25-27 Jun. 1991
(Contract DE-AC04-76DP-00789)
(DE92-005317; SAND-91-2631C; CONF-9106276-5) Avail: NTIS HC/MF A02

BOLT (Beam on Laser Technology) is a rocket experiment to demonstrate electron beam propagation on a laser ionized plasma channel across the geomagnetic field in the ion focused regime (IFR). The beam parameters for BOLT are: beam current I(sub b) = 100 Amps, beam energy of 1--1.5 MeV (gamma =3-4), and a Gaussian beam and channel of radii r(sub b) = r(sub c) = 1.5 cm. The N+1 ionization scheme is used to ionize atomic oxygen in the upper atmosphere. This scheme utilizes 130 nm light plus three IR lasers to excite and then ionize atomic oxygen. The limiting factor for the channel strength is the energy of the 130 nm laser, which is assumed to be 1.6 mJ for BOLT. At a fixed laser energy and altitude (fixing the density of atomic oxygen), the range can be varied by adjusting the laser tuning, resulting in a neutralization fraction axial profile of the form: f(z) = f(sub 0) e(exp minus z)/R, where R is the range. In this paper we consider the propagation of the BOLT beam and calculate the range of the electron beam taking into account the fact that the erosion rates (magnetic and inductive) vary with beam length as the beam and channel dynamically respond to sausage and hose instabilities. DOE

N92-20557# Brookhaven National Lab., Upton, NY.
DESIGN OF A HARMONIC GENERATION FEL EXPERIMENT AT BNL
I. Ben-Zvi, A. Friedman, C. M. Hung, G. Ingold, S. Krinsky, K. M. Yang, K. M. Yu, I. Lehrman, and D. Weissenburger 1991 11 p Presented at the 13th International Free-Electron Laser (FEL) Conference, Santa Fe, NM, 25-30 Aug. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005004; BNL-46682; CONF-9108118-36) Avail: NTIS HC/MF A03

We present design parameters of a harmonic generation FEL experiment to be carried out at the Accelerator Test Facility (ATF) at BNL. This experiment will be carried out as a proof-of-principle for the proposed UV-FEL User's Facility at BNL. In the experiment we plan to triple the frequency of a CO2 seed laser by utilizing two superconducting wigglers and a dispersive section. The first wiggler will be used in conjunction with the CO2 seed laser to generate a ponderomotive force that will bunch the electron beam. The bunching will then be enhanced by the dispersion section. The second wiggler, tuned to the third harmonic of the seed laser will follow. In the beginning of the second wiggler the bunched beam will produce super-radiant emission (characterized by a quadratic growth of the radiated power), then the radiation will be amplified exponentially. The last part of the wiggler will be tapered. We plan to study the evolution of the various radiation growth mechanisms as well as the coherence of the tripled and exponentially amplified radiation. DOE

N92-20558# Lawrence Livermore National Lab., CA.
X RAY CONVERSION IN A PREFORMED AND DRIVEN LASER PLASMA
L. J. Suter, R. L. Kauffman, and M. Cray (Los Alamos National Lab., NM.) Aug. 1991 9 p Presented at the 8th Topical Conference on Atomic Processes in Plasmas, Portland, ME, 25-29 Aug. 1991
(Contract W-7405-eng-48)
(DE92-006883; UCRL-JC-107894; CONF-9108105-7) Avail: NTIS HC/MF A02

Recent 1-D simulation continue to show an effect seen previously; an increase in x ray conversion efficiency in a preformed plasma over what it would be for a disc. For example, at a 3-omega irradiation intensity of 3e(sup 14)w/sq cm, Au disc simulations estimate an instantaneous conversion efficiency of approx. 55 pct. at 1n s. However, if we replace the disc with a preformed Au plasma simulations can predict a conversion efficiency of nearly 90 pct. at 1ns. Our modelling mocks up a situation in which a 1ns preforming pulse of radiation or laser light strikes a disc. We allow plasma to evolve for a delay time which is one of the scaling parameters of our study. At the end of this delay time we fire a laser into the plasma. The intensity of the 3-omega pulse is another scaling parameter. This paper contains x ray conversion results of this simulation. DOE

N92-20659*# Stanford Univ., CA.
SOLID-STATE LASERS FOR COHERENT COMMUNICATION AND REMOTE SENSING Final Technical Report, 1 May 1989 - 31 Dec. 1991
Robert L. Byer Mar. 1992 38 p
(Grant NAGw-1760)
(NASA-CR-190081; NAS 1.26:190081; Rept-4933) Avail: NTIS HC/MF A03 CSCL 20E

Semiconductor-diode laser-pumped solid-state lasers have properties that are superior to other lasers for the applications of coherent communication and remote sensing. These properties include efficiency, reliability, stability, and capability to be scaled to higher powers. We have demonstrated that an optical phase-locked loop can be used to lock the frequency of two diode-pumped 1.06 micron Nd:YAG lasers to levels required for coherent communication. Monolithic nonplanar ring oscillators constructed from solid pieces of the laser material provide better than 10 kHz frequency stability over 0.1 sec intervals. We have used active feedback stabilization of the cavity length of these lasers to demonstrate 0.3 Hz frequency stabilization relative to a reference cavity. We have performed experiments and analysis to show that optical parametric oscillators (OPO's) reproduce the frequency stability of the pump laser in outputs that can be tuned to arbitrary wavelengths. Another measurement performed in this program has demonstrated the sub-shot-noise character of correlations of the fluctuations in the twin output of OPO's. Measurements of nonlinear optical coefficients by phase-matched second harmonic generation are helping to resolve inconsistency in these important parameters. Author

N92-20854# Sandia National Labs., Albuquerque, NM.
ANALYTICAL AND COMPUTATIONAL MODELING OF SMALL LASER-DRIVEN FLYER PLATES
A. V. Farnsworth, Jr. and R. J. Lawrence 1991 25 p Presented at the 16th Annual Joint Firing Set Conference, Livermore, CA, 15-17 Oct. 1991
(Contract DE-AC04-76DP-00789)
(DE92-004207; SAND-91-2182C; CONF-9110282-3) Avail: NTIS HC/MF A03

This work addresses the behavior of a small flyer plate, driven from the end of an optical fiber by the action of a pulse of laser energy. Both analytical and computational techniques have been used to obtain a sound understanding of the phenomena involved. For this analysis, the energy deposition in the metal is assumed to be exponential. The part of the energy deposited that is useful in driving the flyer, is the part having greater intensity than that required to produce vaporization. The equations expressing energy conservation relating to that figure are given, along with the parameterization of the effective deposition depth by the laser absorption coefficient and the thermal conductivity. Solution of these equations is done utilizing experimental data to supply the

parameters, the fraction of energy lost to reflection and radiation (assumed constant), and the ratio of the vaporization energy to effective absorption coefficient. Several consequences of the model, including high-fluence scaling of both the flyer velocity and coupling efficiency, and the moderate-fluence behavior of the impulse coupling coefficient are shown. Comparisons of model results from the late-time flyer velocity with data from experiments using aluminum flyers are shown. Model results for three different metal foils are shown. Note that in all cases, the magnesium flyer outperforms both the aluminum and copper flyers. The numerical modeling of these experiments has utilized the LASNEX hydrocode , which has some of the features needed for the modeling of laser deposition in metal foils. DOE

N92-20870# Environmental Research Inst. of Michigan, Ann Arbor.
LASER SENSOR DATABASE: TAPE DISTRIBUTIONS Annual Report, Oct. 1990 - Sep. 1991
D. C. Carmer and J. L. Grooms Nov. 1991 5 p
(Contract DLA900-88-D-0392)
(AD-A244994; ERIM-213235-2-F) Avail: NTIS HC/MF A01 CSCL 17/5

The Laser Sensor Data Base consists of an archive of 493 data tapes and associated data descriptors residing in computer files. These data were collected under the Air Force's Cruise Missile Advanced Guidance Program, 1984-1989 and include laser range, laser intensity, passive thermal IR and visible TV imagery. The current data base maintenance contract will extend over five years and provides for maintenance of the records, answering inquiries and providing overviews of the imagery. GRA

37 MECHANICAL ENGINEERING

Includes auxiliary systems (nonpower); machine elements and processes; and mechanical equipment.

N92-20070*# Thiokol Corp., Brigham City, UT. Space Operations.
FLIGHT SET 360L009 (STS-36) CASE AND SEALS COMPONENT, VOLUME 2 Final Report
Alan R. Carlisle Nov. 1990 99 p
(Contract NAS8-30490)
(NASA-CR-184288; NAS 1.26:184288; TWR-17548-Vol-2) Avail: NTIS HC/MF A05 CSCL 13I

The performance of the 360L009, Ninth Flight, Redesigned Solid Rocket Motors (RSRM) is assessed in respect to case hardware and joint sealing issues as seen from post-fire assessment of the case and seals. In addition, all of the potential anomalies have been classified and summarized. The post-fire assessment of both motors showed the case segments to be in good condition. Field joint fretting of this flight set ranged from light on most of the joints to locally heavy on three of the joints. The LH aft field joint is the most heavily fretted joint to date; this joint had previously fretted areas from STS-27. No new fretting was found in old fretting locations. However, new frets were found at the edges of repaired areas on both the LH center and aft field joints. All fretting was mapped from the inner clevis leg. The capture feature fretting was not mapped due to the difficulty of measuring the fretting in the capture feature region. It is assumed that the capture feature had damage similar to that on the inner clevis leg. Author

N92-20143# Sandia National Labs., Albuquerque, NM.
CENTER OF PRESSURE CALCULATIONS FOR A BENT-AXIS VEHICLE
W. H. Rutledge and G. F. Polansky 1992 25 p Presented at the 30th AIAA Aerospace Sciences Meeting and Exhibit, Reno, NV, 6-9 Jan. 1992
(Contract DE-AC04-76DP-00789)
(DE92-005186; SAND-91-2936C; AIAA-92-0168; CONF-920157-1) Avail: NTIS HC/MF A03

Bent-axis maneuvering vehicles provide a unique type of control for a variety of supersonic and hypersonic missions. Unfortunately, large hinge moments, incomplete pitching moment predictions, and a misunderstanding of corresponding center of pressure calculations have prevented their application. A procedure is presented for the efficient design of bent-axis vehicles given an adequate understanding of origins of pitching moment effects. In particular, sources of pitching moment contributions will be described including not only normal force, but inviscid axial force and viscous effects as well. Off-centerline center of pressure effects are first reviewed for symmetric hypersonic sphere-cone configurations. Next the effects of the bent-axis geometry are considered where axial force, acting on the deflected tail section, can generate significant pitching moment components. The unique relationship between hinge moments and pitching moments for the bent-axis class of vehicles is discussed. DOE

N92-20222# Southwest Research Inst., San Antonio, TX. Engine, Fuel, and Vehicle Research Div.
EFFECT OF OPERATING CONDITIONS ON RING WEAR IN A NATURAL GAS ENGINE Topical Report, Sep. 1989 - Dec. 1990
M. E. Crane Jul. 1991 70 p
(Contract GRI-5089-293-1848)
(PB92-101500; SWRI-3178-1-3; GETA-91-04; GRI-91/0182)
Avail: NTIS HC/MF A04 CSCL 13I

Studies are outlined of engine operating conditions that promote piston ring wear on a natural gas engine using a statistically designed test program and sensitive wear monitoring with the radioactive tracer technique. The goal was to identify and quantify the key parameters that promote piston ring wear (i.e., coolant temperature, oil temperature, oil type, engine speed, and peak firing pressure). These results would support research directed at achieving extend ring life on stationary gas engines; a limiting factor in periods between major engine overhaul. Author

N92-20244*# Thiokol Corp., Brigham City, UT. Space Operations.
SIMILARITY ANALYSIS FOR THE USE OF THE 1U50228-47 O-RING IN THE S/A ASSEMBLY
G. Scott Eden 1 Oct. 1990 13 p
(Contract NAS8-30490)
(NASA-CR-184289; NAS 1.26:184289; TWR-60826) Avail: NTIS HC/MF A03 CSCL 13I

All pressure seals for the Redesigned Solid Rocket Motor (RSRM) were designed using a minimum 10 percent O-ring squeeze criteria. The similarity between the current O-ring and its proposed replacement is analyzed. The intent of the analysis is to qualify the new O-ring to replace the current configuration O-ring. D.R.D.

N92-20254# Environmental Protection Agency, Ann Arbor, MI. Control Technology and Applications Branch.
EVALUATION OF A VEHICLE EQUIPPED WITH A DIRECT INJECTION ENGINE USING NEAT METHANOL
R. I. Bruetsch and K. H. Hellman Sep. 1991 35 p
(PB92-118009; EPA/AA/CTAB-91/06) Avail: NTIS HC/MF A03 CSCL 13I

The cyclic and steady state vehicle emissions, fuel economy, performance, and cold start behavior of an automobile equipped with a direct injection methanol engine are compared with those of three other comparable vehicles. One of the comparable vehicles was powered by a gasoline fueled engine, and the other two were Diesels. One of the diesel powered vehicles was naturally aspirated and the other was turbocharged. All evaluations were made using the same road load horsepower and equivalent test weight. All the evaluations were conducted at low mileage. Author

N92-20265# Northern Research and Engineering Corp., Woburn, MA.
CURRENTLY AVAILABLE FUEL GAS BOOSTER COMPRESSOR EQUIPMENT FOR SMALL GAS TURBINE ENGINES Topical Report, Dec. 1989 - May 1991

H. B. Faulkner Nov. 1991 23 p
(Contract GRI-5086-233-1436)
(PB92-127026; GRI-91/0328) Avail: NTIS HC/MF A03 CSCL 13I

The distribution of natural supply pressures in the United States was briefly reviewed, and 3.0 psig was selected as basis for the study. The characteristics of booster compressors for 104 gas turbine engines of less than 37 MW were estimated, and nine representative engines below 5 MW were selected. A telephone inquiry was made to obtain costs for boosters for these engines from five suppliers. The booster cost, per KW of engine output, rises as the engine size decreases in the size range below 5 MW, and it rises sharply below about 2 MW. The booster equipment is readily available, but the demand for continuous duty compressors in this size range is not large enough to produce great economies of scale. Also frame size coverage is quite coarse, leading to oversizing for many applications. GRA

N92-20324 Georgia Inst. of Tech., Atlanta.
REDUCTION OF COMPLIANCE IN SPACE-BASED REDUNDANT DEGREE-OF-FREEDOM MANIPULATORS Ph.D. Thesis
Timothy Fredrick Patterson 1991 310 p
Avail: Univ. Microfilms Order No. DA9136244

Space-based activities of any kind place a premium on simplicity and versatility. Versatility makes it possible to contend with unforeseen events. Simplicity makes it possible to obtain higher reliability and greater ease of operation. The two are not always complementary. Due to the cost of transportation to earth orbit or beyond, space-based manipulators are necessarily of lightweight construction. As a result, space-based manipulators are considerably more compliant, i.e. flexible, than earth-based manipulators. Redundant manipulators using self-bracing strategies combine the qualities of versatility and simplicity to compensate for the increased flexibility. The use of bracing strategies to alter redundant manipulator compliance characteristics is investigated. To fully exploit this approach, a thorough understanding of the nonsingular or unconstrained and singular or constrained compliance matrix properties is required. It also requires the ability to concisely describe the properties. Solution of the compliance matrix eigenvalue problem yields six eigenscrews; a wrench on an eigenscrew produces a twist on the same eigenscrew. This leads to a generalization of the center-of-compliance concept, the compliant-axis, and a new method of classifying compliance matrices. Two new and distinct eigenvalue problem formulations yield the twist- and wrench-compliant axis concepts. A twist on a twist-compliant axis produces a couple, and a wrench on a wrench compliant-axis produces a translation. The properties of the three eigenvalue problems, for both the nonsingular and singular cases, are investigated. The results are applied to the problem of bracing mechanism selection. This problem does not easily yield a simple and direct solution. Two iterative solution methods are presented. An example design problem is also given. Dissert. Abstr.

N92-20339# IIT Research Inst., Bartlesville, OK. National Inst. for Petroleum and Energy Research.
EMISSIONS AND FUEL PERFORMANCE EVALUATION OF NATURAL GAS CHALLENGE VEHICLES Final Report, May - Jun. 1991
G. Hemsley and W. Marshall Aug. 1991 121 p
(Contract GRI-5091-254-2181)
(PB92-120047; GRI-91/0256) Avail: NTIS HC/MF A06 CSCL 13F

Students of 24 North American universities designed and installed their own natural gas fuel systems on identical 1991 GMC Sierra pickups for the 1991 Natural Gas Vehicle Challenge student competition. Scoring criteria for the competition included emissions and fuel economy tests according to the EPA Federal Test Procedure (FTP), and a standardized cold start test. The report provides a description of these tests and the results. Emissions analysis included full speciation of the vehicles' hydrocarbon and aldehyde emissions. Estimates were also made of the ozone formation potential of each vehicles' exhaust. The fleet of student-converted vehicles showed the potential of natural gas vehicles to produce lower non-methane hydrocarbon emissions and ozone formation potential than gasoline vehicles. GRA

N92-20401*# Florida Agricultural and Mechanical Univ., Tallahassee. Dept. of Mechanical Engineering.
LUNAR LANDER GROUND SUPPORT SYSTEM Final Report
25 Nov. 1991 151 p Prepared in cooperation with Florida State Univ., Tallahassee
(Contract NASw-4435)
(NASA-CR-189975; NAS 1.26:189975) Avail: NTIS HC/MF A08 CSCL 22D

The design of the Lunar Lander Ground Support System (LLGSS) is examined. The basic design time line is around 2010 to 2030 and is referred to as a second generation system, as lunar bases and equipment would have been present. Present plans for lunar colonization call for a phased return of personnel and materials to the moons's surface. During settlement of lunar bases, the lunar lander is stationary in a very hostile environment and would have to be in a state of readiness for use in case of an emergency. Cargo and personnel would have to be removed from the lander and transported to a safe environment at the lunar base. An integrated system is required to perform these functions. These needs are addressed which center around the design of a lunar lander servicing system. The servicing system could perform several servicing functions to the lander in addition to cargo servicing. The following were considered: (1) reliquify hydrogen boiloff; (2) supply power; and (3) remove or add heat as necessary. The final design incorporates both original designs and existing vehicles and equipment on the surface of the moon at the time considered. The importance of commonality is foremost in the design of any lunar machinery. Author

N92-20551# Oak Ridge National Lab., TN.
AGING RELATED DEGRADATION IN TURBINE DRIVES AND GOVERNORS FOR SAFETY RELATED PUMPS
D. F. Cox 1991 26 p Presented at the 19th Nuclear Regulatory Commission (NRC) Water Reactor Safety Information Meeting, Bethesda, MD, 28-30 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005120; CONF-911079-14) Avail: NTIS HC/MF A03

This study is being performed to examine the relationship between time dependent degradation, and current industry practices in the areas of maintenance, surveillance, and operation of stem turbine drive for safety related pumps. These pumps are located in the Auxiliary Feedwater (AFW) system for pressurized water reactor (PWR) plants, and the Reactor Core Isolation Cooking (RCIC) and High Pressure Coolant Injection (HPCI) systems for Boiling Water Reactor (BWR) facilities. This research has been conducted by examining current information in the Nuclear Plant Reliability Data System (NPRDS), reviewing Licensee Event Reports, thoroughly investigating contacts with operating plant personnel, and by personal observation. This information was reviewed to determine the cause of each reported event and the method of discovery. From this data attempts have been made at determining the predictability of events and possible preventive measures that may be implemented. DOE

N92-20663*# Sikorsky Aircraft, Stratford, CT.
ENHANCED AUTOMATED SPIRAL BEVEL GEAR INSPECTION
Harold K. Frint and Warren Glasow Mar. 1992 56 p Sponsored in part by Army Aviation Systems Command
(Contract NAS3-25961)
(NASA-CR-189125; NAS 1.26:189125; AVSCOM-TR-91-C-048)
Avail: NTIS HC/MF A04 CSCL 13I

Presented here are the results of a manufacturing and technology program to define, develop, and evaluate an enhanced inspection system for spiral bevel gears. The method uses a multi-axis coordinate measuring machine which maps the working surface of the tooth and compares it with nominal reference values stored in the machine's computer. The enhanced technique features a means for automatically calculating corrective grinding machine settings, involving both first and second order changes,

to control the tooth profile to within specified tolerance limits. This enhanced method eliminates the subjective decision making involved in the tooth patterning method, still in use today, which compares contract patterns obtained when the gear is set to run under light load in a rolling test machine. It produces a higher quality gear with significant inspection time and cost savings.
Author

N92-20683# Colorado School of Mines Research Foundation, Inc., Golden.
WORKSHOP REPORT: ADVANCED WELDING SCIENCE FOR DOD APPLICATION: THE GENESIS OF THE ARMY WELDING MICROFACTORY Final Report, 1 May - 31 Aug. 1991
David L. Olson Jun. 1991 109 p Workshop held in Golden, CO, 20-22 Mar. 1991
(Contract DAAL03-91-G-0075)
(AD-A244476; MT-CWJR-091-011; ARO-28768.1-MS-CF) Avail: NTIS HC/MF A06 CSCL 13/5

A workshop was held to identify the welding and joining needs of the defense-related industries, and to discuss the opportunities afforded these industries to solve the needs by applying new methodology and knowledge available from the research establishment. These needs and opportunities were given approximate dates of interest which established a crude chronological prioritization for each area. Specific opportunities were matched to specific needs to suggest project areas where research and development would make contributions providing major technological impact. Various organizational concepts by which welding and joining research, development, and technological transfer could be integrated for maximum impact to achieve the most direct impact were introduced and discussed. GRA

N92-20691# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
INSTRUMENTATION OF A DIESEL ENGINE FOR OIL FILM THICKNESS MEASUREMENTS USING FIBER OPTICS AND LASER FLUORESCENCE M.S. Thesis
Edward N. Ingles Jun. 1991 67 p
(Contract N00123-89-G-0580)
(AD-A245095) Avail: NTIS HC/MF A04 CSCL 11/8

An apparatus was designed to measure the oil film thickness in a production diesel engine using the laser fluorescence technique. The apparatus incorporated fiber optic technology in its design in an attempt to improve on the ease of installation, portability, durability, and signal to noise ratio of previous designs using conventional optics. Bench tests and operational tests were conducted to evaluate the performance of the design. These tests indicate that the goals of the design were achieved, with a signal to noise ratio of the new design comparable to that of the conventional optics design. GRA

N92-20812# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
OIL RHEOLOGY ADJACENT TO THE SCRAPER RING OF A DIESEL ENGINE M.S. Thesis
Dennis C. Logan Jun. 1991 80 p
(Contract N00123-89-G-0580)
(AD-A245263) Avail: NTIS HC/MF A05 CSCL 11/8

Several recent experiments have been made to determine lubricant flow patterns in engine journal bearings. A laser fluorescence technique allows accurate data collection of the oil film thickness on the ring pack of a production diesel engine. The data collected from the Kubota EA300N IDI engine consisted of five different types of lubricant--two single-grades, two multi-grades, and a synthetic multi grade. The data was analyzed and it was found that while oil cross-flow circumferentially around the scraper ring is not present in fired cases, it is present in the motored cases. In addition, oil flow under the ring was evaluated with results consistent with previous observations; the flows observed suggest that the oil flow is between the ring and liner. Finally, a model for upstrokes that predicts the inlet wetting height for varying ring load was evaluated with positive results. GRA

N92-20815*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
EVALUATION OF AN INNOVATIVE HIGH TEMPERATURE CERAMIC WAFER SEAL FOR HYPERSONIC ENGINE APPLICATIONS Ph.D. Thesis, 1991
Bruce M. Steinetz Feb. 1992 195 p
(NASA-TM-105556; E-6048; NAS 1.15:105556) Avail: NTIS HC/MF A09 CSCL 11A

A critical mechanical system in advanced hypersonic engines is the panel-edge seal system that seals gaps between the articulating engine panels and the adjacent engine splitter walls. Significant advancements in seal technology are required to meet the extreme demands placed on the seals, including the simultaneous requirements of low leakage, conformable, high temperature, high pressure, sliding operation. In this investigation, the design, development, analytical and experimental evaluation of a new ceramic wafer seal that shows promise of meeting these demands will be addressed. A high temperature seal test fixture was designed and fabricated to measure static seal leakage performance under engine simulated conditions. Ceramic wafer seal leakage rates are presented for engine-simulated air pressure differentials (up to 100 psi), and temperature (up to 1350 F), sealing both flat and distorted wall conditions, where distortions can be as large as 0.15 inches in only an 18 inch span. Seal leakage rates are low, meeting an industry-established tentative leakage limit for all combinations of temperature, pressure and wall conditions considered. A seal leakage model developed from externally-pressurized gas film bearing theory is also presented. Predicted leakage rates agree favorably with the measured data for nearly all conditions of temperature and pressure. Discrepancies noted at high engine pressure and temperature are attributed to thermally-induced, non-uniform changes in the size and shape of the leakage gap condition. The challenging thermal environment the seal must operate in places considerable demands on the seal concept and material selection. Of the many high temperature materials considered in the design, ceramics were the only materials that met the many challenging seal material design requirements. Of the aluminum oxide, silicon carbide, and silicon nitride ceramics considered in the material ranking scheme developed herein, the silicon nitride class of ceramics ranked the highest because of their high temperature strength; resistance to the intense heating rates; resistance to hydrogen damage; and good structural properties. Baseline seal feasibility has been established through the research conducted in this investigation. Recommendations for future work are also discussed. Author

N92-20850# Army Cold Regions Research and Engineering Lab., Hanover, NH.
AUTOMOTIVE AND CONSTRUCTION EQUIPMENT FOR ARCTIC USE: MATERIALS PROBLEMS
Deborah Diemand Nov. 1991 25 p
(AD-A244835; CRREL-TD-91-5) Avail: NTIS HC/MF A03 CSCL 11/6

At low temperatures, most materials become stiff or brittle or both, including metals, rubber and other elastomers, and many plastics. This problem is exacerbated, especially in equipment with diesel engines, because the engines run rougher and the increased vibration is only slightly damped by shock absorbers and vibration mounts that become stiff and ineffective in the cold. The increased stiffness of the softer elastomers such as those used in seals, tires and belts may cause leakage or other problems. In addition, volume changes with lowering temperatures may cause problems in assemblies with close tolerances, such as bearings. The objective of this digest is to provide a discussion of the general types of problems that will be encountered in automotive and construction equipment when used in the extreme cold and to provide guidelines for overcoming them. The properties and problems of metals are discussed first, followed by a discussion of plastics and elastomers. GRA

38 QUALITY ASSURANCE AND RELIABILITY

Includes product sampling procedures and techniques; and quality control.

N92-20074# National Aeronautical Establishment, Ottawa (Ontario).
NONDESTRUCTIVE EVALUATION OF ADHESIVELY-BONDED JOINTS
A. Fahr and S. Tanary (Ottawa Univ., Ontario) 15 Sep. 1989 12 p Presented at the 69th Specialist Meeting of the AGARD Structures and Materials Panel, Brussels, Belgium, 1-6 Oct. 1989 Previously announced as N90-28074
(NAE-LTR-ST-1723; CTN-92-60407) Avail: NTIS HC/MF A03

The problem of detecting poor adhesives has been partially solved and methods using the velocity or attenuation of ultrasonic waves appear to be sensitive to adhesive properties. The problem of detecting poor adhesion due to contamination or improper substrate surface preparation remains unresolved. Techniques using ultrasonic interface or Lamb waves appear to have some potential for the evaluation of adhesive and interfacial bond properties. The acousto ultrasonic (AU) method, which is based on the analysis of simulated stress waves, holds promise for bond integrity evaluation. This technique has some advantages in terms of practical application. A feasibility assessment of the AU technique on single-lap joint specimens which contained voids, zero volume unbonds and degraded adhesives indicates that the technique has potential in the detection of all three types of defects in adhesive bonds. It appears that the stress wave propagation efficiency can be related to the bond strength although such relationship may be affected by adhesive and adherend material and geometry. The relationship suggests that the same microstructural and morphological factors of the bond line (both adhesive as well as interface) that affect the joint integrity also influence the AU stress wave propagation. Thus, it may be possible to obtain a relative measure of the joint integrity from the AU wave propagation characteristics provided that the AU measurement is calibrated with respect to a known sample of the same material and geometry. CISTI

N92-20094# Ames Lab., IA.
NDE OF INTERFACES IN THE TUBE GEOMETRY WITH PIEZOFILM TRANSDUCERS
D. K. Hsu and Zhong Zhang 1991 4 p Presented at the IEEE Ultrasonics Symposium, Lake Buena Vista, FL, 8-11 Dec. 1991
(Contract W-7405-eng-82)
(DE92-006586; IS-M-691; CONF-911220-1) Avail: NTIS HC/MF A01

The flexible polymer piezofilms such as polyvinylidene fluoride (1) (PVDF) possess distinct advantages as ultrasonic transducers for inspecting cylindrically symmetric components, including rods, pipes, cladding, and tube interfaces. The flexibility and contour conforming nature of the film transducer ensure normal incidence and avoid mode conversion. In this work, PVDF transducers are used in the evaluation of interfaces in coaxially extruded Zirconium-Zircaloy tubes and the clamping condition of Nitinol couplers over stainless steel tubing. Detailed description will be given for the evaluation of an interface in a Zirconium-Zircaloy tube, on which the same transducer was used both as the transmitter and the receiver. The multiple echo signals were analyzed and reflection coefficient as small as 0.006 was accurately measured. Comparison will be made with the measurement results of conventional transducers. DOE

N92-20168# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
A BAYES-COMPETING RISK MODEL FOR THE USE OF EXPERT JUDGMENT IN RELIABILITY ESTIMATION
Frank P. A. Coolen, P. R. Mertens (Kemira Oy Vuorikemia, Pori, Finland), and M. J. Newby Aug. 1990 23 p Submitted for publication
(Memo-COSOR-90-32; ETN-92-91109) Avail: NTIS HC/MF A03

In an analysis of the reliability of heat exchangers, a number of causes of failure and a number of potential failure patterns were identified. To allow a simplification of the analysis, five independent groups of failure causes were defined and formed the basis of a competing risks model. Further, lack of data and poor quality data required the experience of 'experts' to be used in a quantitative way through Bayesian methods. To simplify the elicitation of the prior densities, a shape, scale, and location parameter model for the failure time distributions was adopted. ESA

N92-20250# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
ANALYSIS OF A TWO-PHASE INSPECTION MODEL WITH COMPETING RISKS
Frank P. A. Coolen, Rommert Dekker, and Adriaan Smit (Koninklijke/Shell-Lab., Amsterdam, Netherlands) Mar. 1991 49 p
(Memo-COSOR-91-07; ETN-92-91127) Avail: NTIS HC/MF A03

Condition monitoring, as it is usually referred to, is a maintenance strategy where decisions are made depending on regularly measured equipment states or conditions. In literature and in practice, condition monitoring is often advocated as an efficient tool for cost effective maintenance. It reduces uncertainty with respect to actual states of equipment, and may thus avoid unnecessary repair or replacement, compared to techniques such as time based preventive maintenance. However, in many cases it requires capital investment for monitoring equipment. A basic model for the economic evaluation and optimization of condition monitoring techniques is analyzed. The model is based on the assumption that for a certain type of failure mode, equipment passes through an intermediate state between 'as good as new' and 'failed'. This so called 'bad' state can be detected by the inspection technique, allowing preventive maintenance to be planned before equipment failure. Other 'invisible' failure modes may be involved, and these are modeled as a competing risk to evaluate their influence. Apart from providing optimality results for inspection frequencies, sensitivity analysis is also focused upon. The most important model parameters are identified, showing that the full model can be simplified without seriously affecting optimal decision taking. ESA

N92-20301# Ames Lab., IA.
COMPUTERED TOMOGRAPHY: EXPERIMENTAL DATA ACQUISITION AND PARALLELIZATION OF RECONSTRUCTION ALGORITHM Ph.D. Thesis
Richard Karl Powell 12 Nov. 1991 155 p
(Contract W-7405-eng-82)
(DE92-005151; IS-T-1551) Avail: NTIS HC/MF A08

Nondestructive Evaluation of components is a need throughout much of the manufacturing industry that involves high value parts. The aircraft companies are a prime example of this need. The fleet of commercial and military aircraft that is in use worldwide today is aging and consequently it has become critical to develop an economical real time inspection of aircraft components such as wing structures, engine mounts, turbine blades, and various other critical components in modern day aircraft. The materials used in aircraft structures vary substantially today, indeed it is commonplace to see exotic composite materials as well as the more conventional materials such as aluminum and titanium. There are three primary methods used at the Center to do NDE inspections: (1) X ray based, (2) Ultrasonics based, and (3) Eddy current based. Eddy currents are widely used in industry for the determination of the existence of surface cracks and their lengths in conductors. Ultrasonics is used extensively in the production and in-service inspection of composite panels for problems such as delamination and for cracks in metals. X ray methods are used during production of composite based materials and with portable generators, for in-service detection of fatigue cracks. X ray computed tomography image analysis of voids, cracks, and inclusions are currently finding widespread usage in both the aircraft

industry and in many other industrial applications as well. Although each of these inspection types has its own merits, it is basic research into some of the X ray based methods that will discussed in this thesis. DOE

N92-20572# Rolls-Royce Ltd., Derby (England).
A ROLE MODEL FOR QUALITY MANAGEMENT IN FINITE ELEMENT ANALYSIS
John Barlow 1 Nov. 1990 13 p
(PNR-90816; ETN-92-90784) Copyright Avail: NTIS HC/MF A03

Many engineering companies use a quality management system as a means of controlling quality and standards in their products and operations. The national agency for finite element methods and standards has recently issued a quality systems supplement on the application of International Standards Organization (ISO) 9001 in the case of finite element analysis for the design and validation of engineering products. A 'role model' for a quality system designed to fulfill the requirements of that document is presented. Quality aspects of the following topics are covered: management of the analysis operation; acquisition, development, and verification of software; qualification and documentation of analysis methods; project analysis; and education and training of personnel. Comments are included, based on experience of implementing finite element quality procedures. ESA

39 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; and thermal stress.

For applications see *05 Aircraft Design, Testing and Performance* and *18 Spacecraft Design, Testing and Performance.*

N92-20058# Pacific Northwest Lab., Richland, WA.
A SIPA-BASED THEORY OF IRRADIATION CREEP IN THE LOW SWELLING RATE REGIME
F. A. Garner and C. H. Woo (Atomic Energy of Canada Ltd., Pinawa, Manitoba) Nov. 1991 7 p Presented at the International Conference on Fusion Reactor Materials, Clearwater, FL, 17-22 Nov. 1991
(Contract DE-AC06-76RL-01830)
(DE92-006506; PNL-SA-19587; CONF-911111-29) Avail: NTIS HC/MF A02

A model is presented which describes the major facets of the relationships between irradiation creep, void swelling and applied stress. The increasing degree of anisotropy in distribution of dislocation Burger's vectors with stress level plays a major role in this model. Although bcc metals are known to creep and swell at lower rates than fcc metals, it is predicted that the creep-swelling coupling coefficient is actually larger. DOE

N92-20072*# Dynamic Engineering, Inc., Newport News, VA.
WEIGHT, CENTER OF GRAVITY AND MODAL TEST REPORT FOR NTF FAN BLADE SET NO. 3 Final Report
Inger P. Friedman Feb. 1992 67 p
(Contract NAS1-18352)
(NASA-CR-189583; NAS 1.26:189583; DEI-D-425) Avail: NTIS HC/MF A04 CSCL 20K

A complete set of fan blades for the National Transonic Facility (NTF) at the NASA Langley Research Center was recently fabricated by Dynamic Engineering Inc. (DEI). These blades were the third complete set of blades fabricated by the NTF. The first set of blades was fabricated by NASA and installed in the tunnel in December 1981. This original set was destroyed in a mishap in January 1989. The second set of blades is currently in use in the NTF. The third set of blades recently fabricated by DEI is a spare set. In order to ensure that the blades met the requirements, DEI performed a series of tests on each of the completed blades. In addition, a model survey was conducted on each blade to define the dynamic characteristics. Discussed here are the blade tests conducted by DEI and the test results. The test set-ups and procedures are discussed in detail. The results obtained for each of the 27 blades are documented and comparisons are made between this set of blades and similar data for two previous sets of NTF fan blades. Author

N92-20105# Argonne National Lab., IL.
EFFECT OF DAMAGE ON THE MODAL PARAMETERS OF A CYLINDRICAL SHELL
M. G. Srinivasan and C. A. Kot 1992 19 p Presented at the 10th International Modal Analysis Conference, San Diego, CA, 3-6 Feb. 1992
(Contract W-31-109-eng-38)
(DE92-006998; ANL/CP-74111; CONF-920234-3) Avail: NTIS HC/MF A03

The objective of the study was to investigate the feasibility of assessing damage to structural systems by measuring the changes in the dynamic characteristics of a thin circular cylindrical shell with both ends open. Theoretical and experimental modal analyses were performed for the shell. Subsequently, a notch was machined into the shell simulating a small amount of damage. The shell with the notch was again subjected to experimental modal analysis. A comparison of the modal parameters determined from the tests before and after the shell was damaged showed that the natural frequencies were not sensitive to the crack introduced. However, some of the mode shapes showed significant changes, establishing that the mode shapes were the more sensitive parameters for damage detection. DOE

N92-20149 Texas Univ., Austin.
A SEMI-ANALYTICAL FINITE ELEMENT PROCEDURE FOR AXISYMMETRIC ELASTOMERIC SOLIDS UNDER GENERAL LOADING Ph.D. Thesis
Ronald Eugene Marusak 1991 116 p
Avail: Univ. Microfilms Order No. DA9200678

A semi-analytical finite element procedure, using Fourier series, is developed to compute the large deformations and deflections in axisymmetric elastomeric solids subjected to nonaxisymmetric loading. Nearly incompressible and incompressible, isotropic strain energy density functions describe the material mechanical properties. The nearly incompressible functions become compatible with an analytical integration scheme by using a novel variable to approximate the dilatation. A useful set of displacement boundary conditions is tabulated. Formulas for applied force and pressure boundary conditions are derived. A large spherical elastomeric bearing is analyzed with the procedure. Dissert. Abstr.

N92-20175# Technische Univ., Berlin (Germany, F.R.). Fachbereich Verkehrwesen.
THE AUTOMATIC COMPLETE EVALUATION OF PHOTOELASTIC INTERFERENCE PATTERNS USING DIGITAL IMAGE ANALYSIS Ph.D. Thesis [DIE AUTOMATISCHE VOLLSTAENDIGE AUSWERTUNG SPANNUNGSOPTISCHER INTERFERENZBILDER MITTELS DIGITALER BILDANALYSE]
Bernd Welzel 1991 126 p In GERMAN
(ETN-92-91153) Avail: NTIS HC/MF A07

The development of a general automatized process for the complete and field by field evaluation of a plane stress using photoelastic interference patterns is described. The components of a photoelastic experiment are presented and the light intensity distribution in the polariscope is derived for a general case. It is found that the image analytical process developed for the separation of normal stresses, in connection with the phase shift process further developed, displays the great accuracy of the calculated stress components, the minimization of the necessary interactive operation, and the modular construction of the program system. ESA

N92-20177# Rolls-Royce Ltd., Derby (England). Advanced Research Lab.
PHASE STEPPING FRINGE ANALYSIS APPLIED TO MOIRE INTERFEROMETRY
J. B. Brownell and R. J. Parker 1 Oct. 1990 4 p Presented at Applied Optics and Opto-Electronics, Nottingham, England, 17-20

Sep. 1990
(PNR-90854; ETN-92-90848) Copyright Avail: NTIS HC/MF A01

A paper which showed how the linking together of the Moire interferometer and a powerful personal computer with suitable software resulted in the prospect of a complete test and measurement system that can provide high quality data from the Moire interferometry technique that has previously been unavailable to the stress engineer is introduced. Within this paper the work conducted to develop automated analysis methods for Moire interferometry is described. The design considerations taken into account for the analysis hardware and software are also described together with the operation of the complete optical system and computer based analysis package. Examples of the output from the software package are given. The limitations and difficulties that are to be overcome if such a method is to fulfill its potential are discussed. ESA

N92-20178# Rolls-Royce Ltd., Derby (England).
A FULLY AUTOMATED SYSTEM FOR MONITORING SHORT CRACK GROWTH
L. Grabowski, I. W. Hussey, and J. Roche 1 Apr. 1991 8 p Repr. from Fatigue Fract. Engng. Mater. Struct., v. 14, no. 2/3, 1991 p 309-315 Previously announced in IAA as A91-18048
(PNR-90857; ETN-92-90850) Copyright Avail: NTIS HC/MF A02

A fully automated crack monitoring system used to study the growth of short cracks on Waspaloy at ambient temperature is described. Freely initiated fatigue cracks were detected using this system. Frequent monitoring enabled crack growth to be recorded over 2000 cycle increments. Several methods of data presentation were reviewed, the most appropriate being a linear plot of growth rate versus crack length. ESA

N92-20190# British Columbia Univ., Vancouver. Dept. of Mechanical Engineering.
APPLICATION OF THE INVERSE STRUCTURAL MODIFICATION PROGRAM (INSTRUM) TO NONLINEAR PROPERTY CHANGES
M. J. Smith and S. G. Hutton Sep. 1990 63 p Sponsored by Defence Research Establishment Atlantic
(DREA-CR-90-452; CTN-92-60438) Avail: NTIS HC/MF A04

The INSTRUM (inverse structural modification) program is used to modify an existing finite element model of a structure so that its natural frequencies meet certain prescribed values. The program had previously been developed to the point where it worked well for linear property changes. INSTRUM was then modified to improve the handling of nonlinear property changes. The most important modification was replacing the original predictor corrector algorithm with Newton's method. It is shown that Newton's method greatly improves the solutions for nonlinear property changes while maintaining the accuracy of linear property changes. Another important modification was replacing the Simplex equation solver with a quasi-Newton routine. Examples are presented to show the types of problems INSTRUM can solve, using curved beams and thick/thin shell elements having nonlinear property characteristics for most of the examples. The performance of INSTRUM for nonlinear property changes is evaluated and some suggestions are made for obtaining best results. A user interface for creating INSTRUM files is described and an example of its operation is included. Author (CISTI)

N92-20194*# Vigyan Research Associates, Inc., Hampton, VA.
STRUCTURAL DYNAMICS AND VIBRATIONS OF DAMPED, AIRCRAFT-TYPE STRUCTURES Final Report
Maurice I. Young Washington NASA. Langley Research Center Feb. 1992 118 p
(Contract NAS1-18585)
(NASA-CR-4424; NAS 1.26:4424) Avail: NTIS HC/MF A06 CSCL 20K

Engineering preliminary design methods for approximating and predicting the effects of viscous or equivalent viscous-type damping treatments on the free and forced vibration of lightly damped aircraft-type structures are developed. Similar developments are presented for dynamic hysteresis viscoelastic-type damping treatments. It is shown by both engineering analysis and numerical illustrations that the intermodal coupling of the undamped modes arising from the introduction of damping may be neglected in applying these preliminary design methods, except when dissimilar modes of these lightly damped, complex aircraft-type structures have identical or nearly identical natural frequencies. In such cases, it is shown that a relatively simple, additional interaction calculation between pairs of modes exhibiting this 'modal response' phenomenon suffices in the prediction of interacting modal damping fractions. The accuracy of the methods is shown to be very good to excellent, depending on the normal natural frequency separation of the system modes, thereby permitting a relatively simple preliminary design approach. This approach is shown to be a natural precursor to elaborate finite element, digital computer design computations in evaluating the type, quantity, and location of damping treatment. Author

N92-20212*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
EXPLICIT ROBUST SCHEMES FOR IMPLEMENTATION OF A CLASS OF PRINCIPAL VALUE-BASED CONSTITUTIVE MODELS: THEORETICAL DEVELOPMENT
A. F. Saleeb (Akron Univ., OH.) and S. M. Arnold Nov. 1991 21 p
(NASA-TM-105345; E-6714; NAS 1.15:105345) Avail: NTIS HC/MF A03 CSCL 20K

The issue of developing effective and robust schemes to implement a class of the Ogden-type hyperelastic constitutive models is addressed. To this end, explicit forms for the corresponding material tangent stiffness tensors are developed, and these are valid for the entire deformation range; i.e., with both distinct as well as repeated principal-stretch values. Throughout the analysis the various implications of the underlying property of separability of the strain-energy functions are exploited, thus leading to compact final forms of the tensor expressions. In particular, this facilitated the treatment of complex cases of uncoupled volumetric/deviatoric formulations for incompressible materials. The forms derived are also amenable for use with symbolic-manipulation packages for systematic code generation. Author

N92-20228# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Light Structures.
EFFECT OF PROTECTIVE SURFACE LAYERS ON THE DYNAMIC RESPONSE OF LAMINATE AND SANDWICH PANELS IN LOW VELOCITY IMPACT LOADING
Z. Tao and O. Saarela 1991 34 p
(PB92-127463; ISBN-951-22-0749-4; Rept-91-B26) Avail: NTIS HC/MF A03 CSCL 20K

The impact behavior of laminate and sandwich panels was investigated. The effect that protective surface layers have on impact response was also determined. Test materials used in the study were glassfiber/vinylester laminates and glassfiber/-vinylester/PVC-core sandwich structures. Polypropylene and polyurethane were used as a protective surface layer. According to the test results, the impact responses of solid laminate panels and sandwich panels differ considerably. The impact resistance of solid laminates was significantly improved by protective surface layers. The effect of the protective layer on the impact resistance of sandwich panels was small. The contact force and the dynamic response predicted with the finite element analysis program were in good agreement with the experimental results for solid laminate panels. Predicted impact force histories for sandwich panels were satisfactory, but significant disagreement existed in the strain histories. GRA

N92-20277*# Martin Marietta Corp., Denver, CO. Astronautics Group.
MEASUREMENT OF MECHANICAL AND THERMOPHYSICAL PROPERTIES OF DIMENSIONALLY STABLE MATERIALS FOR SPACE APPLICATIONS Final Report, 12 Nov. 1990 - 22 Aug. 1991
Suraj P. Rawal and Mohan S. Misra Mar. 1992 164 p Original contains color illustrations
(Contract NAS1-18230)
(NASA-CR-189552; NAS 1.26:189552; MCR-92-1320) Avail: NTIS HC/MF A08; 2 functional color pages CSCL 20K

Mechanical, thermal, and physical property test data was generated for as-fabricated advanced composite materials at room temperature (RT), -150 and 250 F. The results are documented of mechanical and thermophysical property tests of IM7/PEEK and discontinuous SiC/Al (particulate (p) and whisker (w) reinforced) composites which were tested at three different temperatures to determine the effect of temperature on material properties. The specific material systems tested were IM7/PEEK (0)8, (0, + or - 45, 90)s, (+ or - 30, 04)s, 25 vol. pct. (v/o) SiCp/Al, and 25 v/o SiCw/Al. RT material property results of IM7/PEEK were in good agreement with the predicted values, providing a measure of consolidation integrity attained during fabrication. Results of mechanical property tests indicated that modulus values at each test temperature were identical, whereas the strength (e.g., tensile, compressive, flexural, and shear) values were the same at -150 F, and RT, and gradually decreased as the test temperature was increased to 250 F. Similar trends in the strength values was also observed in discontinuous SiC/Al composites. These results indicate that the effect of temperature was more pronounced on the strength values than modulus values. Author

N92-20288 Georgia Inst. of Tech., Atlanta.
APPLICATION OF THERMOMECHANICAL WEAR THEORY Ph.D. Thesis
Jinseung Yang 1991 136 p
Avail: Univ. Microfilms Order No. DA9136258

The thermomechanical wear model was extended to explain the thermal phenomena observed in sliding wear. The purposes are to develop transient wear equations by which the transition from mild to severe wear can be estimated, and to develop a method to apply the thermomechanical wear theory to real situations. In order to study the contribution of the thermal stress to complete contact stress, a dimensionless parameter, Gt, is used which represents the relative importance of the thermal stress contribution. To make thermomechanical wear criteria, the temperature dependent yield strength relation is used. The wear maps can be used as wear criteria to predict the transition of wear of ceramics as well as some steels. Maximum principle stress theory in the brittle regime and von Mises criteria in the ductile regime are used as failure criteria to make the wear maps. The wear maps show three regions: an immediate wear region, a conditional wear region and a no wear region. These wear maps were compared with experimental data. Both data show good agreement in trend and magnitude. Dissert. Abstr.

N92-20352# Sandia National Labs., Albuquerque, NM.
HEFF: A USER'S MANUAL AND GUIDE FOR THE HEFF CODE FOR THERMAL-MECHANICAL ANALYSIS USING THE BOUNDARY-ELEMENT METHOD
C. M. St.John and K. Sanjeevan Dec. 1991 164 p
(Contract DE-AC04-76DP-00789)
(DE92-007216; SAND-87-7075) Avail: NTIS HC/MF A08

The HEFF Code combines a simple boundary-element method of stress analysis with the closed form solutions for constant or exponentially decaying heat sources in an infinite elastic body to obtain an approximate method for analysis of underground excavations in a rock mass with heat generation. This manual describes the theoretical basis for the code, the code structure, model preparation, and step taken to assure that the code correctly performs its intended functions. The material contained within the report addresses the Software Quality Assurance Requirements for the Yucca Mountain Site Characterization Project. DOE

N92-20390# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction Scientifique de la Resistance des Structures.
ASYMPTOTIC BEHAVIOR IN HF DYNAMICS OF CONTINUOUS ELASTIC MEDIA Final Report [COMPORTEMENT ASYMPTOTIC EN DYNAMIQUE HF DES MILIEUX CONTINUS ELASTIQUES. RAPPORT FINAL]
J. P. Ollivry May 1991 63 p In FRENCH
(Contract DRET-89-34-001)
(ONERA-RT-110/3454-RY-102-R; ETN-92-90877) Avail: NTIS HC/MF A04

The main results available for the study of the symptotic behavior of the spectrum of elliptic limit problems involved in the Weyl theorem and its numerous development are presented. These results are used to predict the high frequency vibrational behavior of continuous elastic media. Planar plates and thin panels are given particular attention. Formulas are obtained allowing for calculation of an estimated modal density for panels of any geometric shape. ESA

N92-20410*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
ANALYSIS OF SHELL-TYPE STRUCTURES SUBJECTED TO TIME-DEPENDENT MECHANICAL AND THERMAL LOADING Final Report, Mar. 1990
G. J. Simitses Nov. 1991 88 p
(Grant NAG3-534)
(NASA-CR-189051; NAS 1.26:189051) Avail: NTIS HC/MF A05 CSCL 20K

This report deals with the development of a general mathematical model and solution methodology for analyzing the structural response of thin, metallic shell-like structures under dynamic and/or static thermomechanical loads. In the mathematical model, geometric as well as the material-type of nonlinearities are considered. Traditional as well as novel approaches are reported and detailed applications are presented in the appendices. The emphasis for the mathematical model, the related solution schemes, and the applications, is on thermal viscoelastic and viscoplastic phenomena, which can predict creep and ratchetting. Author

N92-20452# Helsinki Univ. of Technology, Espoo (Finland). Lab. of Light Structures.
STATIC STRENGTH CHARACTERISTICS OF MECHANICAL JOINTS IN GFRP LAMINATES
T. Brander, T. Karlemo, and O. Saarela 1991 112 p
(PB92-127448; Rept-91-B20; ISBN-951-22-0426-6) Avail: NTIS HC/MF A06 CSCL 20K

Thermoset polymer matrix composites may be joined by adhesive bonding or by mechanical means such as bolting or riveting. Mechanical tests of bolted and riveted joints were conducted to provide experimental data for analysis and comparison with theoretical strength values. Glass-fiber reinforced polymer (GFRP) laminates prepared by the resin transfer molding (RTM) method were used, and four different layups were tested. Test results show reasonable correlation with data published by others. Precisely defining the onset of failure proved difficult, leading to some uncertainty in the correlation of measured and calculated failure loads. Failure energies of different joint configurations were also estimated from measured mechanical forces and displacements. GRA

N92-20513*# Texas Univ., San Antonio. Div. of Engineering.
COMPUTATIONAL SIMULATION OF COUPLED MATERIAL DEGRADATION PROCESSES FOR PROBABILISTIC LIFETIME STRENGTH OF AEROSPACE MATERIALS Final Report
Lola Boyce and Callie C. Bast Mar. 1992 29 p
(Grant NAG3-867)
(NASA-CR-187234; NAS 1.26:187234) Avail: NTIS HC/MF A03 CSCL 20K

The research included ongoing development of methodology that provides probabilistic lifetime strength of aerospace materials via computational simulation. A probabilistic material strength degradation model, in the form of a randomized multifactor interaction equation, is postulated for strength degradation of structural components of aerospace propulsion systems subjected to a number of effects or primative variables. These primative variable may include high temperature, fatigue or creep. In most cases, strength is reduced as a result of the action of a variable. This multifactor interaction strength degradation equation has been randomized and is included in the computer program, PROMISS. Also included in the research is the development of methodology to calibrate the above described constitutive equation using actual experimental materials data together with linear regression of that data, thereby predicting values for the empirical material constraints for each effect or primative variable. This regression methodology is included in the computer program, PROMISC. Actual experimental materials data were obtained from the open literature for materials typically of interest to those studying aerospace propulsion system components. Material data for Inconel 718 was analyzed using the developed methodology. Author

N92-20568# Sandia National Labs., Livermore, CA.
FAILURE RESISTANCE OF THIN SHELLS AGAINST PROJECTILE PENETRATION
K. V. Trinh and J. D. Gruda Jul. 1991 26 p Presented at the 1991 American Society of Mechanical Engineers (ASME) Pressure Vessels and Piping Conference, San Diego, CA, 23-27 Jun. 1991
(Contract DE-AC04-76DR-00789)
(DE92-005501; SAND-91-8468; CONF-910602-52) Avail: NTIS HC/MF A03

A series of finite element analyses was performed to study the penetrations of high velocity projectiles impacting thin stationary shells. We determined the failure effects of various penetration parameters. In this study, failure was defined as the complete penetration of the projectile through the wall thickness (punch-through). The parameter effects were measured in terms of minimum projectile velocities required for punch-through. The parameters under study were the shape of the shell, shell thickness, shell material, shell boundary condition, projectile diameter, projectile edge radius, and projectile length. We used the finite element code DYNA2D with a damage model developed at Sandia National Laboratories for ductile materials. This damage model tracks a damage coefficient that predicts void growth in materials. Projectile velocities ranged from 4000 in/sec to 11,000 in/sec. The projectiles weight ranged from 0.1 lb to 0.9 lb. DOE

N92-20584*# Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
A FINITE ELEMENT PROGRAM FOR POSTBUCKLING CALCULATIONS (PSTBKL) Final Report
G. T. Simitses, R. L. Carlson, and R. Riff Dec. 1991 104 p
(Grant NAG3-534)
(NASA-CR-189091; NAS 1.26:189091) Avail: NTIS HC/MF A06 CSCL 20K

The object of the research reported herein was to develop a general mathematical model and solution methodologies for analyzing the structural response of thin, metallic shell structures under large transient, cyclic, or static thermochemical loads. This report describes the computer program resulting from the research. Among the system responses associated with these loads and conditions are thermal buckling, creep buckling, and ratcheting. Thus geometric and material nonlinearities (of high order) have been anticipated and are considered in developing the mathematical model. The methodology is demonstrated through different problems of extension, shear, and of planar curved beams. Moreover, importance of the inclusion of large strains is clearly demonstrated, through the chosen applications. Author

N92-20645# National Inst. of Standards and Technology, Gaithersburg, MD.
PROCEEDINGS OF THE 23RD JOINT MEETING OF THE US-JAPAN COOPERATIVE PROGRAM IN NATURAL RESOURCES PANEL ON WIND AND SEISMIC EFFECTS Final Report
N. J. Raufaste Sep. 1991 639 p Meeting held in Tsukuba, Japan, 14-17 May 1991
(PB92-116425; NIST/SP-820) Avail: NTIS HC/MF A99; also available SOD HC $31.00 as 003-003-03107-1 CSCL 20K

Presented here are the proceedings of the 23rd Joint Meeting of the U.S.-Japan Panel on Wind and Seismic Effects. The meeting was held at the Public Works Research Institute, Tsukuba, Japan, during May 14 to 17, 1991. The papers were presented under seven themes: wind engineering, earthquake engineering, storm surge and Tsunamis, Joint Cooperative Research Program, International Decade for Natural Disaster Reduction, and summaries of Task Committee Workshop Reports. Author

N92-20678*# State Univ. of New York, Buffalo. Dept. of Civil Engineering.
ADVANCED DEVELOPMENT OF THE BOUNDARY ELEMENT METHOD FOR ELASTIC AND INELASTIC THERMAL STRESS ANALYSIS Ph.D. Thesis, 1987 Final Report
Donald P. Henry, Jr. Cleveland, OH NASA Dec. 1991 263 p
(Grant NAG3-712)
(NASA-CR-189079; NAS 1.26:189079) Avail: NTIS HC/MF A12 CSCL 20K

The focus of this dissertation is on advanced development of the boundary element method for elastic and inelastic thermal stress analysis. New formulations for the treatment of body forces and nonlinear effects are derived. These formulations, which are based on particular integral theory, eliminate the need for volume integrals or extra surface integrals to account for these effects. The formulations are presented for axisymmetric, two and three dimensional analysis. Also in this dissertation, two dimensional and axisymmetric formulations for elastic and inelastic, inhomogeneous stress analysis are introduced. The derivatives account for inhomogeneities due to spatially dependent material parameters, and thermally induced inhomogeneities. The nonlinear formulation of the present work are based on an incremental initial stress approach. Two inelastic solutions algorithms are implemented: an iterative; and a variable stiffness type approach. The Von Mises yield criterion with variable hardening and the associated flow rules are adopted in these algorithms. All formulations are implemented in a general purpose, multi-region computer code with the capability of local definition of boundary conditions. Quadratic, isoparametric shape functions are used to model the geometry and field variables of the boundary (and domain) of the problem. The multi-region implementation permits a body to be modeled in substructured parts, thus dramatically reducing the cost of analysis. Furthermore, it allows a body consisting of regions of different (homogeneous) material to be studied. To test the program, results obtained for simple test cases are checked against their analytic solutions. Thereafter, a range of problems of practical interest are analyzed. In addition to displacement and traction loads, problems with body forces due to self-weight, centrifugal, and thermal loads are considered.
Author

N92-20793# Sheffield Univ. (England). Dept. of Automatic Control and Systems Engineering.
HIGHER ORDER FREQUENCY RESPONSE FUNCTIONS IN NONLINEAR SYSTEM IDENTIFICATION
G. R. Tomlinson (Manchester Univ., England) and S. A. Billings Jun. 1991 13 p Presented at the International Forum on Aeroelasticity and Structural Dynamics, Aachen, Fed. Republic of Germany, 3-6 Jun. 1991
(RR-432; ETN-92-90655) Avail: NTIS HC/MF A03

Higher order Frequency Response Functions (FRF) and their role in the identification of nonlinear systems are described. Higher order FRFs only exist for nonlinear systems and have the property

of visually demonstrating how energy is transferred from one frequency to another, a unique characteristic of nonlinear structures and systems. Determination of these FRFs can be approached from two main directions, using sine excitation by directly measuring the higher order transfer functions which approximate the higher order FRFs or using nonlinear time series methods and probing these to extract the FRFs. The use of such techniques in diagnosing a class of nonlinear structural dynamics problems is presented. ESA

N92-20800# National Aerospace Lab., Amsterdam (Netherlands). Structures and Materials Div.
A SOLUTION FOR THE PROBLEM OF LOAD INTRODUCTION IN BIAXIAL FATIGUE TESTS
G. J. deJong 27 Mar. 1990 11 p Submitted for publication
(NLR-TP-90112-U; ETN-92-90968) Avail: NTIS HC/MF A03

The concept of introduction of biaxial loads in a specimen made of sheets material using soft clamps of unidirectional aramid composite sheet is presented. Using this concept, it is possible to generate realistic biaxial tensile stress states in specimens made of sheet materials without the introduction of unwanted fatigue critical areas. ESA

N92-20839*# Georgia Inst. of Tech., Atlanta. School of Engineering Science and Mechanics.
FORMULATION OF THE NONLINEAR ANALYSIS OF SHELL-LIKE STRUCTURES, SUBJECTED TO TIME-DEPENDENT MECHANICAL AND THERMAL LOADING Final Report
George J. Simitses, Robert L. Carlson, and Richard Riff Dec. 1991 179 p
(Grant NAG3-534)
(NASA-CR-189092; NAS 1.26:189092) Avail: NTIS HC/MF A09 CSCL 20K

The object of the research reported herein was to develop a general mathematical model and solution methodologies for analyzing the structural response of thin, metallic shell structures under large transient, cyclic, or static thermomechanical loads. Among the system responses associated with these loads and conditions are thermal buckling, creep buckling, and ratcheting. Thus geometric and material nonlinearities (of high order) can be anticipated and must be considered in developing the mathematical model. The methodology is demonstrated through different problems of extension, shear, and of planar curved beams. Moreover, importance of the inclusion of large strain is clearly demonstrated, through the chosen applications. Author

N92-20840# Applied Computing Enterprises, Nepean (Ontario).
LITERATURE SURVEY OF ACTIVE DAMPING USING PIEZOELECTRIC DEVICES
Anthony Faria Vaz 12 Mar. 1991 34 p Sponsored by Canadian Space Agency
(ACE-R-CSA-91-3.0; CSA-DSM-CR-91-006; CTN-92-60414)
Avail: NTIS HC/MF A03

Large flexible space structures have significant structural flexibility, meaning that elastic body modes, ranging from very low to very high frequencies, will be very lightly damped. High frequency modes can be attenuated by using viscoelastic structural materials but low frequency modes cannot. A significant amount of research has shown that piezoelectric sensors and actuators can successfully damp structural vibrations. This report provides a literature survey on active damping using piezoelectric devices. A number of different piezoelectric devices have been successfully used to actively damp structural vibrations. The most promising have simple construction. Thin piezoelectric films can be bonded to structural members for use as either actuators or sensors. By geometrically shaping the piezoelectric films, individual modes of a structure can be sensed and controlled. This property can be used to implement a state feedback law in terms of a shaped film. In this manner, high fidelity dynamic models can be used for controller design without the typical penalty of excessive controller complexity. It is suggested that a flat beam cantilever is a suitable structure for initial active damping experimentation. CISTI

N92-20842# Applied Computing Enterprises, Nepean (Ontario).
THEORETICAL DEVELOPMENT FOR AN ACTIVE DAMPING VIBRATION EXPERIMENT
Anthony Faria Vaz 30 Mar. 1991 46 p Sponsored by Canadian Space Agency
(ACE-R-CSA-91-4.0; CSA-DSM-CR-91-007; CTN-92-60415)
Avail: NTIS HC/MF A03

The mathematical models for an active vibration damping experiment are developed. The vibration and interaction equations for a cantilever beam with bonded piezoelectric films are derived. It is shown that such an apparatus is ideal for empirically verifying and extending the control methods described in the literature. The piezoelectric films can be used as either force actuators or strain sensors. Static and dynamic interaction equations are developed for both single and paired piezoelectric films that are either rectangular or shaped. A rectangular film has an electrode bounded by a rectangle and a uniform polling direction, pointing either up or down, throughout the films. A shaped film has an electrode that is bounded by a geometric shape, and a polling direction that varies between up and down in a specified direction throughout the film. The interaction equations are a significant generalization of modeling techniques reported elsewhere. Actuators constructed from rectangular films tend to excite all modes of a structure to varying degrees. Sensors constructed from rectangular films have outputs which are similarly influenced by all the modes of a structure. Such a film can be used as either a modal actuator or a modal sensor. State feedback can also be implemented in terms of a shaped film. Author (CISTI)

N92-20909# Rolls-Royce Ltd., Derby (England).
THE ROLE OF CRACK GROWTH IN DEFECT ASSESSMENT
John Roche and Chris Howland Nov. 1990 7 p
(PNR-90798; ETN-92-90772) Copyright Avail: NTIS HC/MF A02

The gas turbine industry is around fifty years old. The technology of the industry has evolved under the twin impulses of safety and direct operating cost. Since safety should not be compromised, (there are rules to ensure it is not) an assessment of material properties becomes essential. One such property is that of crack growth, and this is often referred to generically as 'defect tolerance'. The components concerned are normally those which rotate, and in the event of failure could cause a significant risk to the aircraft and its passengers. Assessment of a compressor or turbine disc is a multidisciplined method. Here it is viewed from the perspective of the measurement of crack rates. The nucleation of a crack, the measurement of small crack growth rates, the measurements of large crack growth rates and fast fracture, and the four components of total life, are discussed. ESA

N92-20954*# Ohio State Univ., Columbus.
A NOVEL APPROACH IN FORMULATION OF SPECIAL TRANSITION ELEMENTS: MESH INTERFACE ELEMENTS Final Report, Jan. 1989
Nesrin Sarigul Nov. 1991 64 p
(Grant NAG3-790)
(NASA-CR-189050; NAS 1.26:189050) Avail: NTIS HC/MF A04 CSCL 20K

The objective of this research program is in the development of more accurate and efficient methods for solution of singular problems encountered in various branches of mechanics. The research program can be categorized under three levels. The first two levels involve the formulation of a new class of elements called 'mesh interface elements' (MIE) to connect meshes of traditional elements either in three dimensions or in three and two dimensions. The finite element formulations are based on boolean sum and blending operators. MEI are being formulated and tested in this research to account for the steep gradients encountered in aircraft and space structure applications. At present, the heat transfer and structural analysis problems are being formulated from uncoupled theory point of view. The status report: (1) summarizes formulation for heat transfer and structural analysis; (2) explains formulation of MEI; (3) examines computational efficiency; and (4) shows verification examples. Author

N92-21019# Brown Univ., Providence, RI. Div. of Engineering.
DYNAMIC PLASTIC INSTABILITIES IN NONLINEAR INELASTIC RESPONSE TO PULSE LOADING Final Report, 15 Mar. 1987 - 14 Sep. 1991
P. S. Symonds 15 Nov. 1991 5 p
(Contract DAAL03-87-K-0038)
(AD-A244486; ARO-24362.13-EG) Avail: NTIS HC/MF A01
CSCL 20/11

The report summarizes the main obtained results with emphasis on the energy approach introduced first for a single degree of freedom model, and then developed for a two degree of freedom beam model. The elastic strain energy function is plotted as a surface over the displacement coordinate plane, whose topography depends on the plastic strains. It provides a guide to the various types of beam response, which may be quasiperiodic or chaotic, and enables their dependence on parameters such as impulse magnitude and damping to be clearly understood. GRA

42 GEOSCIENCES (GENERAL)

N92-20798*# United States Man and the Biosphere, Washington, DC.
DIRECTORY OF BIOSPHERE RESERVES IN THE UNITED STATES
Jun. 1991 121 p Sponsored by NASA, Washington; Dept. of Agriculture; DOE; Dept. of Interior; Dept. of State; Agency for International Development; EPA; NOAA; NSF; Peace Corps; and Smithsonian Inst.
(NASA-CR-190095; NAS 1.26:190095; PB91-182584; PUB-9885) Avail: NTIS HC/MF A06 CSCL 08B

The United States Man and the Biosphere Coordinating Committee for Biosphere Reserves is making the directory available to encourage use of U.S. biosphere reserves for scientific observation, research, education, and demonstration purposes, and to promote cooperation and networking involving biosphere reserves. The directory includes listings of the administrative and professional staff for each of the 91 administrative sites within the 47 U.S. biosphere reserves designed as of January 1991. The listings include each person's job title and field of principal admistrative responsibility or professional specialization. Author

43 EARTH RESOURCES AND REMOTE SENSING

Includes remote sensing of earth resources by aircraft and spacecraft; photogrammetry; and aerial photography.

For instrumentation see *35 Instrumentation and Photography.*

N92-20191# World Meteorological Organization, Geneva (Switzerland).
A NONPARAMETRIC FRAMEWORK FOR LONG-RANGE STREAMFLOW FORECASTING Final Report
James A. Smith, Gerald N. Day, and Michael D. Kane Jul. 1991 33 p
(WMO/TD-428; WCASP-17) Avail: NTIS MF A03

The Extended Streamflow Prediction (ESP) procedure of the National Weather Service River Forecast System (NWSRFS) produces long range forecasts of streamflow through the use of hydrologic models. A nonparametric statistical framework is developed for long range streamflow forecasting with hydrologic models. Within this framework climate information and hydrologic model errors are accommodated. Results are presented for a test implementation of ESP for a basin in the southeastern U.S. during the severe drough period of 1988. Author

N92-20192# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
LOCATION OF KIMBERLITES USING LANDSAT THEMATIC MAPPER IMAGES AND AERIAL PHOTOGRAPHS: THE REDONDAO DIATREME, BRAZIL
Raimundo Almeida-Filho and Raimundo M. G. CasteloBranco (Universidade Federal do Ceara, Fortaleza, Brazil) Sep. 1991 19 p Submitted for publication
(INPE-5313-PRE/1710) Avail: NTIS HC/MF A03

LANDSAT Thematic Mapper images and aerial photographs were used in the detection of kimberlite derived materials in the Redondao test site. In this area, kimberlite derived soils show a flora constituted mainly by grasses and shrubs, which differ from the surrounding savanna-park (cerrado) vegetation cover. Band ratio images were able to distinguish kimberlite derived materials by enhancing areas with different vegetation covers. However, the coarse spatial resolution of LANDSAT TM images compared with the spatial variability of the study area, and the removal of topographic shadowing effects on ratio images blurred several landscape features. To increase discrimination, LANDSAT Thematic Mapper ratio images were merged with digitized aerial photographs through intensity, hue, and saturation (IHS) color transforms. The resulting merged color composite highlighted the spatial and spectral features of the study area permitting an accurate definition of the kimberlite derived materials within the Redondao diatreme. Author

N92-20211# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
STEREOSCOPIC HRV-SPOT IMAGES RESAMPLING THROUGH QUASI-EPIPOLAR CURVES Thesis
Antonio Eliseu Dias Sommerlatte 1991 114 p In PORTUGUESE; ENGLISH summary
(INPE-5279-TDI/449) Avail: NTIS HC/MF A06

For remote sensing applications, the two-dimensional automatic correlation is a key method for identifying homologous pixels. The large data sets and the computational effort make it a very costly process. In order to reduce these costs, this work presents a resampling method, and its analysis, for accelerating the homologous pixels identification. The data used was from the French satellite SPOT, aquired by the HRV sensor. The simplification is possible by means of the determination of quasi-epipolar curves in a way similar to aerial photography epipolar lines. These curves make the transversal parallax negligible, thus the automatic correlaion becomes unidimensional. Author

N92-20321# Geological Survey, Tacoma, WA. Water Resources Div.
USE OF LANDSAT IMAGERY TO ESTIMATE GROUND-WATER PUMPAGE FOR IRRIGATION ON THE COLUMBIA PLATEAU IN EASTERN WASHINGTON, 1985
P. VanMetre and P. Seevers 1991 44 p Prepared in cooperation with Washington State Dept. of Ecology, Olympia
(PB92-107002; USGS/WRI-89-4157) Avail: NTIS HC/MF A03 CSCL 08H

A method is presented for estimating ground water pumpage for irrigation on the Columbia Plateau in eastern Washington. The method combines annual water application rates estimated from pumpage data with acreage of irrigated crops that was mapped using LANDSAT imagery. The area chosen for the study includes Grant, Lincoln, Adams, and Franklin Counties. Pumpage data were obtained from private owners and were collected by U.S. Geological Survey personnel for the 1982 through 1985 growing seasons over the four county area. Ground water pumpage for irrigation was estimated for 1985 by using the LANDSAT mapping results and a regression equation developed from pumpage data. The regression equation was used to estimate the annual depth of water applied to irrigated lands on the basis of crop type, available capacity of th soil, annual precipitation, and irrigation system type; an assessment of accuracy of the estimates also was made. Author

N92-20358 Newcastle-upon-Tyne Univ. (England).
POST-PROCESSING STRATEGIES FOR PRECISE GPS STATIC SURVEYING Ph.D. Thesis
Mohamed A. Khalid 1990 242 p
Avail: Univ. Microfilms Order No. BRDX93794

High-precision relative geodetic positioning can be determined from the Global Positioning System (GPS) carrier beat phase measurements on the L1 and/or L2 signals. A number of aspects of the required post-processing techniques have been investigated. In order to do this, the NUDOP software package was developed. It is capable of processing data from 10 receivers simultaneously tracking 10 satellites over a single observation session. The determination of the integer cycle ambiguities (the whole number of cycles at the initial epoch) of the doubly differenced observations is a crucial element in high-precision positioning techniques with GPS. A detailed study of their behavior and the best way to resolve them for small to medium-sized networks was made. Two procedures for ambiguity resolution were evaluated. It was found that the most important measure for resolving an ambiguity bias is its estimated formal error and that both procedures are capable of resolving an ambiguity bias even if it has the maximum deviation from the nearest integer (0.5 cycles), provided that its formal error is 0.1 cycles or less. The results using the L1 and L2 measurements are compared to those from an ionosphere-free solution (L3). It was found that results from the L1 solution were better than those from L2 and that when processing small networks (less than 50 km), it is necessary to decide between reducing the ionospheric effect by using the L3 observable, and using an L1 only solution which will have significantly less noise. The role of the receiver clocks was studied and two models for receiver clock behavior, estimated at the preprocessing stage using pseudo-range measurements, were tested. The preferred model uses a second degree polynomial to approximate clock offset, drift and drift rate. Dissert. Abstr.

N92-20395# Beleidscommissie Remote Sensing, Delft (Netherlands).
DEVELOPMENT OF AN INFORMATION SYSTEM FOR THE REPRODUCTION OF REMOTE SENSING IMAGES AND OTHER LAND DATA ON BEHALF OF WATER QUALITY MANAGEMENT IN THE YSSELMEER REGION (NETHERLANDS) [ONTWIKKELING VAN EEN INFORMATIESYSTEEM VOOR DE WEERGAVE VAN REMOTE SENSING BEELDEN EN ANDERE RUIMTELIJKE GEGEVENS TEN BEHOEVE VAN WATERKWALITEITSBEHEER IN HET IJSSELMEERGEBIED]
J. W. Miltenberg and H. Buiteveld (Rijksinstituut voor Zuivering Afvalwater, Lelystad, Netherlands) Aug. 1991 23 p In DUTCH
(BCRS Proj. OP-1.20)
(BCRS-91-05; ETN-92-90982) Avail: NTIS HC/MF A03

A user friendly Geographic Information System (GIS) was developed for the Ysselmeer region, with a particular view to improving the accessibility of satellite pictures for water quality management. The system is built around pc Arc/Info (version 3.3), using macros written in SML (Simple Macro Language) and a PASCAL program to develop a menu structure. Pc Arc/Info uses vector inventories and has many options for the reproduction of maps and possibilities to call map information interactively; it is therefore suited for the development of a GIS and for the proper reproduction of remote sensing information. Geostatic analysis is not possible within Arc/Info. ESA

N92-20396# Beleidscommissie Remote Sensing, Delft (Netherlands).
INTERPRETATION AND IDENTIFICATION OF THE POSSIBILITIES FOR USE OF NOAA-AVHRR SATELLITE PICTURE FOR THE MANAGEMENT AND STUDY OF THE YSSELMEER REGION (NETHERLANDS) [INTERPRETATIE EN IDENTIFICATIE VAN GEBRAUIKSMOGELIJKHEDEN VAN NOAA-AVHRR SATELLIETOPNAMEN IN HET BEHEER EN ONDERZOEK VAN HET IJSSELMEERGEBIED]
Jul. 1991 45 p Prepared in cooperation with Rijksinstituut voor Zuivering Afvalwater, Lelystad, Netherlands; DHV Raadgevend Ingenieursbureau B.V., Amersfoort, Netherlands; and Royal Netherlands Meteorological Inst., De Bilt
(BCRS Proj. TO-1.16)
(BCRS-91-06; ETN-92-90983) Avail: NTIS HC/MF A03

A visual interpretation of a time series of NOAA satellite pictures of the Ysselmeer region was performed with a view to a more precise identification of the possibilities for use in the management and study of that region. It is shown that the satellite pictures contain relevant information concerning algae, water temperature, suspended dust and possibly chlorophyll, as well as the inflow of water on the Ysselmeer. This information completes the data from measuring points at the Ysselmeer. ESA

N92-20397# Beleidscommissie Remote Sensing, Delft (Netherlands).
PMI/CAESAR EVALUATION. PART 1: EVALUATION OF THE COMPARISON OF TWO MULTISPECTRAL SCANNERS FOR USE ABOVE INLAND WATERWAYS. PART 2: RESULTS OF CAESAR RECORDINGS OF THE KETELMEER (NETHERLANDS) ON 5 AND 6 JULY 1989 [PMI/CAESAR EVALUATIE. DEEL 1: EVALUATIE VERGELIJKING VAN TWEE MULTI-SPECTRALE SCANNERS VOOR TOEPASSING BOVEN DE BINNENWATEREN. DEEL 2: RESULTATEN CAESAR OPNAMEN VAN HET KETELMEER VAN 5 EN 6 JULI 1989]
A. H. J. M. Pellemans, G. N. M. Stokman, and W. J. Looyen (National Aerospace Lab., Amsterdam, Netherlands) Aug. 1991 35 p In DUTCH
(BCRS-91-20-Pt-1-2; ETN-92-90988) Avail: NTIS HC/MF A03

Two Imaging Spectrometers (IS), PMI/FLI (Programmable Multichannel Imager/Fluorescence Line Imager) and CAESAR (CCD Airborne Experimental Scanner for Application in Remote Sensing), were compared in order to evaluate the applicability of IS for inland water ways. However, due to technical problems, no measurements could be performed with the PMI scanner. Only two of the none CAESAR bands proved to be useful due to saturation, sunlight and overradiation of the land. Therefore a coupling between CAESAR picture and in situ measurements is not possible, and statements concerning the reliability of the statistical correlations between CAESAR pixel values and ground measurements cannot be made. The CAESAR pictures provide significant information for visual interpretation. However a survey picture is missing, so that the visual patterns are difficult to couple with physical phenomena. ESA

N92-20400 Texas Technological Univ., Lubbock.
AN ANALYSIS OF RADIOMETRIC CORRECTION EFFECTS ON LANDSAT THEMATIC MAPPER IMAGERY Ph.D. Thesis
David Allan Waits 1991 80 p
Avail: Univ. Microfilms Order No. DA9129392

Land-use classifications and spectral indices are commonly created from raw radiance satellite data. These data are known to be distorted due to sensor instrumentation errors and atmospheric contributions. The overall objective of this study was to evaluate different radiometric corrections of Thematic Mapper (TM) data on land-use classification results and the derivation of spectral indices. A Landsat-4 TM digital image of a diverse agricultural area in the High Plains region of eastern New Mexico was the primary data source. Four different geometrically corrected image data sets were analyzed. The first was raw radiance data in radiometrically uncorrected form. The other three images were radiometrically corrected transforms created using procedures that adjusted the raw data for radiometric calibration and atmospheric correction. All four images were classified in terms of land-use using identical training fields. Supervised classifications were developed using ground truth data, and quantitative analyses were performed on all resulting classifications. Ground-based spectral data for various land-use types were compared qualitatively to response data derived from the raw and radiometrically corrected image data for the same land-use types. Four spectral index models were applied to each of the four image data sets. The derived spectral indices were transforms that emphasized the quantitative

differences among image data sets. The results are presented.
Dissert. Abstr.

N92-20426# National Aerospace Lab., Amsterdam (Netherlands). Space Div.
MEASUREMENTS ON DIRECTIONAL REFLECTANCE AND ACQUISITION ON STEREO INFORMATION BY CAESAR
W. J. Looyen, W. Verhoef, J. G. P. W. Clevers, J. Lamers, and J. Boerma (Proefstation voor de Akkerbouw en de Groenteteelt in de Vollegronds, Netherlands) 15 Mar. 1990 20 p Presented at the International Geoscience and Remote Sensing Society Symposium, 1990
(NLR-TP-90093-U; ETN-92-90966) Avail: NTIS HC/MF A03

CAESAR, a multispectral pushbroom scanner, which became available for specific remote sensing research in 1988, is adressed. CAESAR is capable of obtaining information on the directional reflectance of objects in the ground by the acquisition of multispectral data in different look modes. The information is used to improve crop classification and to model atmospheric correction of CAESAR data. SAILH canopy reflectance model simulations are compared with the radiance values measured by CAESAR. The data acquired in different look modes are used to obtain stereo information . ESA

N92-20820# Tel-Aviv Univ. (Israel). Interdisciplinary Center for Technological Analysis and Forecasting
THERMAL MAPPING OF SALT PANS AT THE DEAD SEA WORKS
Abraham Tal and David Issahary (Dead Sea Works, Beer Sheva, Israel) 13 Nov. 1990 9 p Presented at the Binational France-Israel Conference on Applications of Remote Sensing, Herzlia, Israel, 12-13 Nov. 1990; sponsored by Israeli Ministry of Science and Technology, and CNES
(ITN-91-85120) Avail: NTIS HC/MF A02

The waters of the Dead Sea are unique in their chemical composition, having a very high concentration of alkaline salts, mainly Na, K, Mg and Br. The very hot and arid climate of this region enables separation of the different salts by evaporation of the solvent in shallow open pans. A project, financed by the Israeli Dead Sea Works potash plant, has used miltitemporal thermal mapping from Landsat TM images to monitor the process. Analysis has shown phenomena such as improper mixing of the solution in some pans and springs of brackish water in others which act as inhibitors to the proper settling of salts from the solution. Furthermore, apparent settling of potash early in the process, in pans intended for NaCl deposition only, has also been shown.
Author (ISA)

N92-20868# Miami Univ., FL.
REMOTE SENSING USING A GROUND BASED 94 GHz DOPPLER RADAR Final Report, 15 Aug. 1986 - 24 Aug. 1990
R. Lhermitte 5 Sep. 1991 64 p
(Contract DAAL03-86-K-0145)
(AD-A244937; ARO-24062.5-GS) Avail: NTIS HC/MF A04
CSCL 17/9

The original purpose of this research was to explore the usefulness and performance of a 94 GHz pulse Doppler radar for the remote sensing of clouds and precipitation. The approach was first to design and assemble a 94 GHz Doppler radar. The observations of clouds and precipitation with that radar were conducted along with the interpretations of the observational data in an effort to make contributions toward a better understanding of the physics and dynamics of clouds and precipitation systems.
Author (GRA)

N92-20882# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
USE OF TM/LANDSAT DATA TO ESTIMATE CHLOROPHYLL CONCENTRATION AND TURBIDITY IN THE BARRA BONITA RESERVOIR
Evlyn Marcia LeaodeMoraesNovo and Claudia Zuccari FernandesBraga Jun. 1991 15 p Presented at the 24th International Symposium on Remote Sensing of Environment, Rio de Janeiro, Brazil, 27-31 May 1991
(INPE-5314-PRE/1711) Avail: NTIS HC/MF A03

This paper reports preliminary results from the research project developed to model the relationship between TM/LANDSAT data and limnological variable in the Barra Bonita reservoir, located in Sao Paulo State. Multispectral LANDSAT-5 data recorded on July 4, 1989 were acquired in the TM bands 1, 2, 3, and 4. These data were digitally processed and converted into apparent reflectance values. Secchi depth, temperature, total suspended solid concentration, total chlorophyll pigment concentration, and nutrient concentration were determined concurrently with TM/LANDSAT-5 overpass. TM/LANDSAT bands were geometrically corrected and the average of a three by three pixel window in each band for each sample station was related to field data using stepwise regression techniques. Stepwise techniques were also applied to field variables to identify how optically active parameters were influenced by nutrients. The adjusted coefficient of determination, r(sup 2), for the relationship between TM bands and Secchi depth was 0.73 and the regression model included bands TM1 and TM3. The stepwise regression using Secchi depth as dependent variable was run against all the remaining limnological variables to identify which of them would be vicariously represented by the remote sensing model. The coefficient of determination for the Secchi model was 0.77 with the following limnological independent variables in the equation: total phosphorus, total nitrogen, total suspended solids, and total chlorophyll pigment concentration. Author

N92-20956# Instituto de Pesquisas Espaciais, Sao Jose dos Campos (Brazil).
INTEGRATION OF TOPOGRAPHICAL AND REMOTELY-SENSED DATA FOR THE CLASSIFICATION OF TROPICAL RAIN FORESTS: THE CASE OF TAPAJO'S NATIONAL FOREST [INTEGRACAO DE DADOS TOPOGRAFICOS E DE SENSORIAMENTO REMOTO PARA A CLASSIFICACAO DE FLORESTAS TROPICAIS: CASO DA FLORESTA NACIONAL DE TAPAJOS]
Pedro Hernandez Filho, Yosio Edemir Shimabukuro, and David Chung Liang Lee Apr. 1991 11 p In PORTUGUESE; ENGLISH summary
(INPE-5258-PRE/1682) Avail: NTIS HC/MF A03

The objective of this work is to integrate the orbital images with cartographical data for classifying tropical forest areas. The Tapajo's National Forest, located in Para State, between Santerem and Itaituba cities, was selected for this study. It comprises about 600,000 hectares covered predominantly by dense tropical forest. The methodology consists on the digitization and integration of vegetation maps, topographic charts, and satellite images by utilizing a geographical information system. The results achieved show the potentiality of integrated analyses of topographic and spectral data to study tropical forest areas. Author

N92-21004# Westinghouse Hanford Co., Richland, WA.
GROUND WATER MAPS OF THE HANFORD SITE, JUNE 1991
G. L. Kasza, M. J. Hartman, F. M. Hodges, and D. C. Weekes Dec. 1991 52 p
(Contract DE-AC06-87RL-10930)
(DE92-006498; WHC-EP-0394-3) Avail: NTIS HC/MF A04

Ground Water Maps of the Hanford Site is a series of reports prepared semiannually to present water level measurements taken each June and December at the Hanford Site. Each report presents a compilation of the ground water level measurement data from the unconfined aquifer and selected confined aquifer wells collected during the subject month. The ground water data are also presented in graphic form in a series of ground water maps to illustrate the hydrologic conditions on the Hanford Site. The purpose of this document is to provide water level data to support many of the ground water monitoring programs on the Hanford Site. Water level data measured in ground water monitoring wells on the Hanford Site during June 1991 are presented. The depth to the ground water was measured at the wellhead. The procedure for measuring the depth to water and recording the data is contained

in environmental investigations instruction (EII) 10.2 of the Environmental Investigation and Site Characterization Manual, WHC-CM-7-7 (WHC 1988). DOE

N92-21049# Lawrence Livermore National Lab., CA.
ELECTRICAL RESISTANCE TOMOGRAPHY TO MONITOR VADOSE WATER MOVEMENT
A. Ramirez, W. Daily, and D. LaBrecque (Arizona Univ., Tucson.) Sep. 1991 9 p Presented at the Environmental Remediation 1991 Conference, Pasco, WA, 8-11 Sep. 1991
(Contract W-7405-eng-48)
(DE92-003064; UCRL-JC-108155; CONF-910981-44) Avail: NTIS HC/MF A02

We report results of one test in which electrical resistance tomography (ERT) was used to map the changes in electrical resistivity in the vadose zone as a function of time while water infiltration occurred. The ERT images were used to infer shape and movement of the infiltration plume in the unsaturated soil. We supplied a continuous water source at a point about 10 feet below the surface (at the end of a shallow screened hole) for only a short time (approx. 2.5 hours). This pulsed source introduced a 'slug' of water whose infiltration was followed to about a 60 foot depth during a 23 hour period. The ERT images show resistivity decreases as the water content of the vadose zone increased while water was added to the soil; the resistivity of the soil later increased after the supply of water was cut-off and the induced soil moisture began to subside. DOE

44 ENERGY PRODUCTION AND CONVERSION

Includes specific energy conversion systems, e.g., fuel cells; global sources of energy; geophysical conversion; and windpower.

For related information see also *07 Aircraft Propulsion and Power, 20 Spacecraft Propulsion and Power,* and *28 Propellants and Fuels.*

N92-20047# Sandia National Labs., Albuquerque, NM.
REFLUX SOLAR RECEIVER DESIGN CONSIDERATIONS
R. B. Diver 1992 21 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE91-018401; SAND-91-1267C; CONF-920436-2) Avail: NTIS HC/MF A03

Reflux heat-pipe and pool-boiler receivers are being developed to improve upon the performance and life of directly-illuminated tube receiver technology used in previous successful demonstrations of dish-Stirling systems. The design of a reflux receiver involves engineering tradeoffs. In this paper, on-sun performance measurements of the Sandia pool-boiler receiver are compared with results from the reflux receiver thermal analysis model, AEETES. Flux and performance implications of various design options are analyzed and discussed. DOE

N92-20051# Midwest Research Inst., Golden, CO.
NEAR-TERM VIABILITY OF SOLAR HEAT APPLICATIONS FOR THE FEDERAL SECTOR
T. A. Williams Dec. 1991 6 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC02-83CH-10093)
(DE92-001184; NREL/TP-250-4602; CONF-920436-10) Avail: NTIS HC/MF A02

Solar thermal technologies are capable of providing heat across a wide range of temperatures, making them potentially attractive for meeting energy requirements for industrial process heat applications and institutional heating. The energy savings that could be realized by solar thermal heat are quite large, potentially several quads annually. Although technologies for delivering heat at temperatures above 100 C currently exist within industry, only a fairly small number of commercial systems have been installed to date. The objective of this paper is to investigate and discuss the prospects for near term solar heat sales to federal facilities as a mechanism for providing an early market niche to the aid the widespread development and implementation of the technology. The specific technical focus is on mid-temperature (100 to 350 C) heat demands that could be met with parabolic trough systems. Federal facilities have several features relative to private industry that may make them attractive for solar heat applications relative to other sectors. Key features are specific policy mandates for conserving energy, a long term planning horizon with well defined decision criteria, and prescribed economic return criteria for conservation and solar investments that are generally less stringent than the investment criteria used by private industry. Federal facilities also have specific difficulties in the sale of solar heat technologies that are different from those of other sectors, and strategies to mitigate these difficulties will be important. For the baseline scenario developed in this paper, the solar heat application was economically competitive with heat provided by natural gas. The system levelized energy cost was $5.9/MBtu for the solar heat case, compared to $6.8/MBtu for the life cycle fuel cost of a natural gas case. A third-party ownership would also be attractive to federal users, since it would guarantee energy savings and would not need initial federal funds. DOE

N92-20053# Midwest Research Inst., Golden, CO.
UNCERTAINTY OF CALORIMETER MEASUREMENTS AT NREL'S HIGH FLUX SOLAR FURNACE
C. E. Bingham Dec. 1991 8 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC02-83CH-10093)
(DE92-001186; NREL/TP-254-4593; CONF-920436-12) Avail: NTIS HC/MF A02

The uncertainties of the calorimeter and concentration measurements at the High Flux Solar Furnace (HFSF) at the National Renewable Energy Laboratory (NREL) are discussed. Two calorimeter types have been used to date. One is an array of seven commercially available circular foil calorimeters (gardon or heat flux gages) for primary concentrator peak flux (up to 250 W/sq cm). The second is a cold-water calorimeter designed and built by the University of Chicago to measure the average exit power of the reflective compound parabolic secondary concentrator used at the HFSF (over 3.3 kW across a 1.6/sq cm) exit aperture, corresponding to a flux of about 2 kW/sq cm. This paper discussed the uncertainties of the calorimeter and pyrheliometer measurements and resulting concentration calculations. The measurement uncertainty analysis is performed according to the ASME/ANSI standard PTC 19.1 (1985). Random and bias errors for each portion of the measurement are analyzed. The results show that as either the power or the flux is reduced, the uncertainties increase. Another calorimeter is being designed for a new, refractive secondary which will use a refractive material to produce a higher average flux (5 kW/sq cm) than the reflective secondary. The new calorimeter will use a time derivative of the fluid temperature as a key measurement of the average power out of the secondary. A description of this calorimeter and test procedure is also presented, along with a pre-test estimate of major sources of uncertainty. DOE

N92-20054# Midwest Research Inst., Golden, CO.
THE PHOTOVOLTAIC MANUFACTURING TECHNOLOGY PROJECT: A GOVERNMENT/INDUSTRY PARTNERSHIP
R. L. Mitchell, C. E. Witt, and G. D. Mooney Dec. 1991 7 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC02-83CH-10093)
(DE92-001194; NREL/TP-214-4588; CONF-920436-15) Avail: NTIS HC/MF A02

The Photovoltaic Manufacturing Technology (PVMaT) project is a government/industry photovoltaic manufacturing research and development (R&D) project composed of partnerships between the federal government (through the US Department of Energy) and members of the US photovoltaic (PV) industry. It is designed

to assist the US PV industry in improving manufacturing processes, accelerating manufacturing cost reductions for PV modules, increasing commercial product performance, and generally laying the groundwork for a substantial scale-up of US-based PV manufacturing plant capabilities. The project is being carried out in three separate phases, each focused on a specific approach to solving the problems identified by the industrial participants. These participants are selected through competitive procurements. Furthermore, the PVMaT project has been specifically structured to ensure that these PV manufacturing R&D subcontract awards are selected with no intention of either directing funding toward specific PV technologies (e.g., amorphous silicon, polycrystalline thin films, etc.), or spreading the awards among a number of technologies (e.g., one subcontract in each area). Each associated subcontract under any phase of this project is, and will continue to be, selected for funding on its own technical and cost merits. Phase 1, the problem identification phase, was completed early in 1991. Phase 2 is now under way. This is the solution phase of the project and addresses problems of specific manufacturers. The envisioned subcontracts under Phase 2 may be up to three years in duration and will be highly cost-shared between the US government and US industrial participants. Phase 3, is also under way. General issues related to PV module development will be studied through various teaming arrangements. DOE

N92-20057# Sandia National Labs., Albuquerque, NM.
PROTOTYPE DISH TESTING AND ANALYSIS AT SANDIA NATIONAL LABORATORIES
J. W. Grossman, R. M. Houser, and W. W. Erdman 1991 11 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-001621; SAND-91-1263C; CONF-920436-5) Avail: NTIS HC/MF A03

During the past year, Sandia National Laboratories performed on-sun testing of several dish concentrator concepts. These tests were undertaken at the National Solar Thermal Test Facility (NSTTF). Two of the tests were performed in support of the DOE Concentrator Receiver Development Program. The first was on-sun testing of the single-element stretched-membrane dish; this 7-meter diameter dish uses a single preformed metal membrane with an aluminized polyester optical surface and shows potential for future dish-Stirling systems. The next involved two prototype facets from the Faceted Stretched-Membrane Dish Program. These facets, representing competitive design concepts, are closest to commercialization. Five 1-meter triangular facets were tested on-sun as part of the development program for a solar dynamic system on Space Station Freedom. While unique in character, all the tests utilized the Beam Characterization System (BCS) as the main measurement tool and all were analyzed using the Sandia-developed CIRCE2 computer code. The BCS is used to capture and digitize an image of the reflected concentrator beam that is incident on a target surface. The CIRCE2 program provides a computational tool, which when given the geometry of the concentrator and target as well as other design parameters will predict the flux distribution of the reflected beam. One of these parameters, slope error, is the variable that has a major effect in determining the quality of the reflected beam. The methodology used to combine these two tools to predict uniform slope errors for the dishes is discussed in this document. As the Concentrator Development Programs continue, Sandia will test and evaluate two prototype dish systems. The first, the faceted stretched-membrane dish, is expected to be tested in 1992, followed by the full-scale single-element stretched-membrane dish in 1993. These tests will use the tools and methodology discussed in this document. DOE

N92-20112# International Fuel Cells Corp., South Windsor, CT.
FUEL CELL ENERGY RECOVERY FROM LANDFILL GAS Report, Jan. - Sep. 1991
G. J. Sandelli and R. J. Spiegel 1991 13 p Presented at the 2nd Grove Fuel Cell Symposium, London, England, 24-27 Sep. 1991
(Contract EPA-68-01-0008)
(PB92-121235; EPA/600/D-91/257) Avail: NTIS HC/MF A03 CSCL 10A

Phase 1 results are discussed of an EPA sponsored program to show energy recovery from landfill gas using a commercial phosphoric acid fuel cell power plant. EPA is interested in fuel cells for the application because it is the cleanest energy conversion technology available. Phase 1 is a conceptual design, cist, and evaluation study. The conceptual design of the fuel energy recovery concept is described and its economic and environmental feasibility is projected. Phase 2 covers the construction and testing of a landfill gas pretreatment system which will render landfill gas suitable for use in the fuel cell. Phase 3 is the demonstration of the energy recovery concept. Author

N92-20130# Sandia National Labs., Albuquerque, NM.
AEETES: A SOLAR REFLUX RECEIVER THERMAL PERFORMANCE NUMERICAL MODEL
R. E. Hogan, Jr. 1991 10 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-003625; SAND-91-1279C; CONF-920436-7) Avail: NTIS HC/MF A02

Reflux solar receivers for dish-Stirling electric power generation systems are currently being investigated by several companies and laboratories. In support of these efforts, the AEETES thermal performance numerical model has been developed to predict thermal performance of pool-boiler and heat-pipe reflux receivers. The formulation of the AEETES numerical model, which is applicable to axisymmetric geometries with asymmetric incident fluxes, is presented in detail. Thermal efficiency predictions agree to within 4.1 percent with test data from on-sun tests of a pool-boiler reflux receiver. Predicted absorber and sidewall temperatures agree with thermocouple data to within 3.3. percent and 7.3 percent, respectively. The importance of accounting for the asymmetric incident fluxes is demonstrated in comparisons with predictions using azimuthally averaged variables. The predicted receiver heat losses are characterized in terms of convective, solar and infrared radiative, and conductive heat transfer mechanisms. DOE

N92-20131# Sandia National Labs., Albuquerque, NM.
DEVELOPMENT OF A CONTROL ALGORITHM FOR A MOLTEN-SALT SOLAR CENTRAL RECEIVER IN A CYLINDRICAL CONFIGURATION
G. J. Kolb 1991 9 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-003627; SAND-91-2544C; CONF-920436-6) Avail: NTIS HC/MF A02

A control algorithm is proposed for a molten-salt solar central receiver in a cylindrical configuration. The algorithm simultaneously regulates the receiver outlet temperature and limits thermal-fatigue damage of the receiver tubes to acceptable levels. The algorithm is similar to one that was successfully tested for a receiver in a cavity configuration at the Central Receiver Test Facility in 1988. Due to the differences in the way solar flux is introduced on the receivers during cloud-induced transients, the cylindrical receiver will be somewhat more difficult to control than the cavity receiver. However, simulations of a proposed cylindrical receiver at the Solar Two power plant have indicated that automatic control during severe cloud transients is feasible. This paper also provides important insights regarding receiver design and lifetime as well as a strategy for reducing the power consumed by the molten-salt pumps. DOE

N92-20138# Pacific Northwest Lab., Richland, WA.
DIURNAL COOL THERMAL ENERGY STORAGE: RESEARCH PROGRAMS, TECHNOLOGICAL DEVELOPMENTS, AND COMMERCIAL STATUS
M. A. Wise Jan. 1992 59 p
(Contract DE-AC06-76RL-01830)
(DE92-006742; PNL-7921) Avail: NTIS HC/MF A04

This report presents an overview of the major federal and private research and development efforts in diurnal cool thermal energy storage for electric load management in buildings. Included are brief technical descriptions and research histories of the technologies and applications of cool thermal storage. The goals, accomplishments, and funding levels of major thermal storage research programs also are summarized. The report concludes with the results of recent field performance evaluations of cool thermal storage installations and a discussion of the current commercial status of thermal storage equipment, including utility participation programs. This report was sponsored by the Technology and Consumer Products (TCP) Division within the Office of Conservation of the U.S. Department of Energy. This report is part of TCP's ongoing effort to examine and evaluate technology developments and research efforts in the areas of lighting, space heating and cooling, water heating, refrigeration, and other building energy conversion equipment. Information obtained through this effort is used as an input in developing the U.S. research agenda in these areas. DOE

N92-20245# Midwest Research Inst., Golden, CO.
RECENT RESULTS FROM DATA ANALYSIS OF DYNAMIC STALL ON WIND TURBINE BLADES
C. P. Butterfield, D. Simms, and S. Huyer (Colorado Univ., Boulder.) Jan. 1992 14 p Presented at the International Energy Agency (IEA) Experts Meeting on Wind Turbine Aerodynamics, Stuttgart (Germany), 3-4 Dec. 1991
(Contract DE-AC02-83CH-10093)
(DE92-001200; NREL/TP-257-4654; CONF-911287-1) Avail: NTIS HC/MF A03

Wind turbines are subjected to dynamic loading from a variety of different sources. Wind shear and turbulence cause time-varying inflow that results in unsteady airloads. Tower shadow, upwind turbine wakes, and yaw angles also introduce unsteady inflow to wind turbine rotors. Wind turbine designers must predict these loads accurately in order to adequately design blades, hubs, and the remaining support structure to achieve a 30-year life. Structural analysts have not been able to predict mean or dynamic loads accurately enough to predict the fatigue life of major wind turbine components with confidence. Part of the problem is due to uncertainty in the stochastic wind environments as mentioned earlier. Another important part of the problem is the lack of basic knowledge of rotary wing airfoil stall performance. There is mounting evidence that dynamic stall may be related to dynamic loads that are greater than predictions. This paper describes some results of investigations of unsteady aerodynamic loads measured on a wind turbine blade. The objective of the investigation is to understand the steady and unsteady stall behavior of wind turbine blades. DOE

N92-20334# Environmental Protection Agency, Research Triangle Park, NC. Air and Energy Engineering Research Lab.
SUB-SLAB PRESSURE FIELD EXTENSION IN SCHOOLS AND OTHER LARGE BUILDINGS Report, 1988 - 1991
D. B. Harris, A. B. Craig, and K. W. Leovic 1991 20 p Presented at the 5th Annual AARST National Fall Conference, Rockville, MD, 9-12 Oct. 1991
(PB92-121268; EPA/600/D-91/260) Avail: NTIS HC/MF A03 CSCL 10A

The experiences of EPA are discussed in using pressure field extension (PFE) to design active subslab depressurization (ASD) systems to reduce radon levels in old and new schools, including instances where the data collected resulted in the installation of smaller systems than expected and selection of high vacuum fans instead of normal mitigation fans. A central collection system for use under very large slabs is discussed and PFE data are given for a hospital under construction. The most direct method of projecting or measuring the performance of an ASD system is to measure the strength and extent of the pressure field established under the slab. The PFE can be determined (during diagnostics) to help design an ASD system and (following installation) to ascertain system performance. In schools and other large buildings, these data are invaluable to provide a system that will mitigate the building without undue cost escalation. Author

N92-20493*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
PROGRESS IN THE DEVELOPMENT OF LIGHTWEIGHT NICKEL ELECTRODE FOR AEROSPACE APPLICATIONS
Doris L. Britton Mar. 1992 19 p Presented at the 3rd International Rechargeable Battery Seminar, Deerfield Beach, FL, 2-4 Mar. 1992; sponsored in part by Ansum Enterprises, Inc.
(NASA-TM-105591; E-6922; NAS 1.15:105591) Avail: NTIS HC/MF A03 CSCL 10B

The NASA Lewis Research Center is currently developing nickel electrodes for nickel-hydrogen (Ni-H2) cells and batteries. These electrodes are lighter in weight and have higher specific energy than the heavy sintered state of the art nickel electrodes. In the present approach, lightweight materials or plaques are used as conductive supports for the nickel hydroxide active material. These plaques (fiber, felt, and nickel plated plastic) are fabricated into nickel electrodes by electrochemically impregnating them with active material. Initial performance tests include capacity measurements at five discharge levels, C/2, 1.0C, 1.37C, 2.0C, and 2.74C. The electrodes that pass the initial tests are life cycle tested at 40 and 80 percent depths of discharge (DOD). Different formulations of nickel fiber materials obtained from several manufacturers are currently being tested as possible candidates for nickel electrodes. Over 7,000 cycles of life cycle testing have been accumulated at 40 percent DOD, using the lightweight fiber electrode in a boiler plate Ni-H2 cell with stable voltage. Author

N92-20648# Midwest Research Inst., Golden, CO.
MANUFACTURING TECHNOLOGY DEVELOPMENT FOR CuInGaSe2 SOLAR CELL MODULES
B. J. Stanbery (Boeing Aerospace Co., Seattle, WA.) Nov. 1991 54 p
(Contract DE-AC02-83CH-10093)
(DE92-001176; NREL/TP-214-4606) Avail: NTIS HC/MF A04

The report describes research performed by Boeing Aerospace and Electronics under the Photovoltaic Manufacturing Technology project. We anticipate that implementing advanced semiconductor device fabrication techniques to the production of large area CuIn(1-x)Ga(x)Se2 (CIGS)/Cd(1-y)Zn(y)S/ZnO monolithically integrated thin film solar cell modules will enable 15 pct. median efficiencies to be achieved in high volume manufacturing. We do not believe that CuInSe2 (CIS) can achieve this efficiency in production without sufficient gallium to significantly increase the band gap, thereby matching it better to the solar spectrum (i.e., x greater than or = 0.2). Competing techniques for CIS film formation have not been successfully extended to CIGS devices with such high band gaps. The SERI-confirmed intrinsic stability of CIS-based photovoltaics renders them far superior to a-Si:H-based devices, making a 30 year module lifetime feasible. The minimal amounts of cadmium used in the structure we propose, compared to CdTe-based devices, makes them environmentally safer and more acceptable to both consumers and relevant regulatory agencies. Large area integrated thin film CIGS modules are the product most likely to supplant silicon modules by the end of this decade and enable the cost improvements which will lead to rapid market expansion. DOE

N92-20671*# Sverdrup Technology, Inc., Brook Park, OH.
DESIGN AND OPTIMIZATION OF A SELF-DEPLOYING SINGLE AXIS TRACKING PV ARRAY Final Report
Anthony J. Colozza Mar. 1992 25 p
(Contract NAS3-25266)
(NASA-CR-189132; E-6911; NAS 1.26:189132) Avail: NTIS HC/MF A03 CSCL 10A

This study was performed in order to design a tracking photovoltaic (PV) array and optimize the design for maximum specific power. The design considerations were minimal deployment time, high reliability, and small stowage volume. The array design was self-deployable, from a compact stowage configuration, using a passive pressurized gas deployment mechanism. The array

structural components consist of a combination of beams, columns, and cables used to deploy and orient a flexible PV blanket. Each structural component of the design was analyzed to determine the size necessary to withstand the various forces to which it would be subjected. An optimization was performed to determine the array dimensions and blanket geometry which produce the maximum specific power. The optimization was performed for both lunar and Martian environments with 4 types of PV blankets (silicon, GaAs/Ge, GaAs CLEFT, and amorphous silicon). For the lunar environment, the amorphous silicon array produced the highest specific power, whereas, for Mars the GaAs CLEFT array produced the highest specific power. A comparison was made to a fixed PV tent array of similar design. The tracking array produced a higher specific power with all types of the PV blankets examined except amorphous silicon at both locations. Author

N92-20855# Sandia National Labs., Albuquerque, NM.
CRITICAL ISSUES IN THE DEVELOPMENT OF HYBRID SOLAR/GAS RECEIVERS FOR DISH/STIRLING SYSTEMS
D. R. Adkins and K. S. Rawlinson 1991 8 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-004352; SAND-91-1321C; CONF-920436-18) Avail: NTIS HC/MF A02

A hybrid solar/gas receiver system will allow Stirling engines to operate with combined solar and gas power sources. One of the most attractive options for building a hybrid system is to integrate a gas-fired heat pipe directly into a heat-pipe solar receiver. Before this union can take place, however, a number of technical issues must be resolved. A design must be found that properly distributes the heat-pipe's working fluid over the heated surfaces and prevents fluid from accumulating at undesirable locations in the heat pipe. Experience that has been gained in developing solar receivers and gas-fired heat pipes under recent Department of Energy solar-thermal dish-electric programs is used in this paper to address many of the technical obstacles to building receiver systems. DOE

N92-21034# Midwest Research Inst., Golden, CO.
THE FEDERAL ADVANCED WIND TURBINE PROGRAM
S. M. Hock, R. W. Thresher, and P. R. Goldman (Department of Energy, Washington, DC.) Dec. 1991 7 p Presented at the 21st American Wind Energy Association Conference: Windpower 1991, Palm Springs, CA, 24-27 Sep. 1991
(Contract DE-AC02-83CH-10093)
(DE92-001189; NREL/TP-257-4625; CONF-9109112-6) Avail: NTIS HC/MF A02

The development of technologically advanced, higher efficiency wind turbines has been identified as a high priority activity by the U.S. wind industry. The Department of Energy's Wind Energy Program has begun a multi-year development program aimed at assisting the wind industry with the design, development, and testing of advanced wind turbine systems that can compete with conventional electric generation for $0.05/kWh at 13 mph sites by the mid-1990s and with fossil-fuel-based generators for $0.04/kWh at 13 mph sites by the year 2000. The development plan consists of four phases: (1) Conceptual Design Studies; (2) Near-Term Product Development; (3) Next Generation Technology Integration and Design; and (4) Next-Generation Technology Development and Testing. The Conceptual Design Studies were begun in late 1990, and are scheduled for completion in the Spring of 1992. Preliminary results from these analyses are very promising and indicate that the goals stated above are technically feasible. This paper includes a brief summary of the Conceptual Design Studies and presents initial plans for the follow-on activities. DOE

N92-21040# Sandia National Labs., Albuquerque, NM.
THE STATUS OF THE US VAWT PROGRAM
H. M. Dodd, D. E. Berg, T. D. Ashwill, H. J. Sutherland, and L. L. Schluter 1991 20 p Presented at the Canadian Wind Energy Association (CWEA) Meeting, Montreal (Canada), 4 Nov. 1991
(Contract DE-AC04-76DP-00789)
(DE92-002931; SAND-91-2386C; CONF-9111131-1) Avail: NTIS HC/MF A03

Vertical axis wind turbine (VAWT) technology in the United States started in the early 1970s directly from the original work in Canada. The close, and very productive relationships among laboratories, universities and industry have continued since that time. This paper briefly discusses the significant technical progress and rather dramatic programmatic changes that have occurred in the past 18 to 24 months on the U.S. side of the border. DOE

N92-20924# Tokyo Univ., Sagamihara (Japan).
BRAYTON-RANKINE TOTAL ENERGY SPACE DYNAMIC POWER SYSTEM ANALYSIS
Zhi-Guang Ling and Koichi Oshima *In its* Proceedings of the Symposium on Mechanics for Space Flight 1990 Mar. 1991 p 69-80 (For primary document see N92-20918 11-34)
Avail: NTIS HC/MF A05

45 ENVIRONMENT POLLUTION

Includes atmospheric, noise, thermal, and water pollution.

N92-20099# Brookhaven National Lab., Upton, NY.
EXPLORING CO2 EMISSIONS REDUCTION STRATEGIES
S. C. Morris, D. Hill, J. Lee, G. Goldstein, and J. Lydick Jan. 1991 6 p Presented at the International Conference on Energy in the 1990's, Pittsburgh, PA, 11-13 Mar. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005393; BNL-46727; CONF-910306-2) Avail: NTIS HC/MF A02

Concern for potential climate change resulting from the greenhouse effect may be the biggest factor in energy planning in the 1990s. A 20 pct. reduction in CO2, the predominant greenhouse gas, has been proposed as a goal by several international and national groups. Its principal source is the combustion of fossil fuels. A substantial reduction in CO2 emissions in the first decade of the 21st century will require major shifts in energy planning and development in the 1990s. An energy systems model, MARKAL, is being used to meet specific CO2 reduction goals. This can provide a technological basis for economic and policy models designed to find the best policy instruments to induce technological and behavioral change. This report focuses on MARKAL results in the electric supply sector. DOE

N92-20100# Oak Ridge National Lab., TN.
ECOLOGICAL INTEGRITY AND THE MANAGEMENT OF ECOSYSTEMS: CONSIDERATIONS OF SCALE AND HIERARCHY
A. W. King 1991 37 p Presented at the Workshop on Ecological Integrity and the Management of Ecosystems, Ontario, 3-5 Apr. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005411; CONF-9104328-1) Avail: NTIS HC/MF A03

Explicit considerations of scale are increasingly a part of the process by which ecologists approach a variety of ecological issues and problems, and hierarchy theory is commonly used to address questions of scale. Thus it is expected and appropriate that the evolving issue of monitoring and managing ecosystem integrity be concerned with questions of scale and hierarchy. Among the issues discussed in this paper are the following: How considerations of scale and hierarchical organization influence the measurement or management of ecosystem integrity; and What considerations of spatial and temporal scale should go into the design of measures for ecosystem integrity. Answers to these questions first require some definitions. What ecosystem integrity is; What ecosystems are; and What scale and hierarchical organization in these ecosystems are. DOE

N92-20108# Jacobs Engineering Co., Pasadena, CA.
GUIDES TO POLLUTION PREVENTION: THE MARINE MAINTENANCE AND REPAIR INDUSTRY
Oct. 1991 70 p
(Contract EPA-68-D8-0112)
(PB91-228817; EPA/625/7-91/015) Avail: NTIS HC/MF A04 CSCL 13B

Marine maintenance and repair facilities generate a variety of waste streams during repair and maintenance of mechanical systems, structural components, upholstery, electrical systems, and surfaces of ships and boats. Typical wastes generated from these operations, which present opportunities for waste reduction, are oils, coolants, lubricants, and cleaning agents; various chemicals; paints and coatings; as well as dusts from sanding, sand blasting, and polishing and refinishing operations. Both source reduction and recycling opportunities are identified. To help companies in the industry identify opportunities for waste reduction at their own facilities, the guide includes a set of worksheets which take the user step by step through an analysis of the on-site waste generating operations and the possibilities for minimizing each waste. Author

N92-20109# Environmental Protection Agency, Cincinnati, OH. Risk Reduction Engineering Lab.
US EPA PROGRAM FOR EVALUATION OF TREATMENT AND UTILIZATION TECHNOLOGIES FOR MUNICIPAL WASTE COMBUSTION RESIDUES
C. C. Wiles 1991 26 p Presented at the 2nd International Symposium on Municipal Waste Combustion, Tampa, FL, 15-19 Apr. 1991
(PB92-121185; EPA/600/D-91/252) Avail: NTIS HC/MF A03 CSCL 13B

Vendors of solidification/stabilization (S/S) and other technologies are cooperating with the U.S. EPA's Office of Research and Development, Risk Reduction Engineering Lab to demonstrate and evaluate the performance of the technologies to treat residues from the combustion of municipal solid waste (MSW). S/S is being emphasized in the current program. The technology may enhance the environmental performance of the residues when disposed in the land, when used as road bed aggregate, as building blocks, and in the marine environment as reefs or shore erosion control barriers. The program includes 4 S/S process types: cement, silicates, cement kiln dust, and a phosphate based process. Residue types being evaluated are fly ash, bottom ash, and combined residues. An array of chemical leaching tests and physical tests are being conducted to characterize the untreated and treated residues. Program design, status, and preliminary results are discussed. The S/S evaluation program is the first part of ORD's Municipal Solid Waste Innovative Technology Evaluation (MITE) program. ORD is also supporting research to address the scientific and other issues associated with MSW combustion residues. Author

N92-20110# Environmental Protection Agency, Cincinnati, OH. Drinking Water Research Div.
COMPARISON OF 5 SOLIDIFICATION/STABILIZATION PROCESSES FOR TREATMENT OF MUNICIPAL WASTE COMBUSTION RESIDUES. PART 1: PHYSICAL TESTING
T. T. Holmes, D. S. Kosson, and C. C. Wiles 1991 22 p Presented at the 2nd International Sumposium on MWC, Tampa, FL, 15-19 Apr. 1991 Prepared in cooperation with Army Engineer Waterways Experiment Station, Vicksburg, MS; and Rutgers-The State Univ., Piscataway, NJ Submitted for publication
(PB92-121193; EPA/600/D-91/253) Avail: NTIS HC/MF A03 CSCL 13B

Results are presented from physical tests used to evaluate MWC residues treated by 5 S/S processes. The physical properties are especially important for determining utilization applications. Considerable emphasis was placed on structural properties and long term durability during exposure to varied environmental conditions. For each process, side by side comparisons were made of physical test results from the (1) unconfined compressive strength (UCS) determinations, (2) the UCS after immersion tests, (3) the wet/dry weathering tests, (4) the freeze/thaw weathering tests, and (5) permeability determinations. In general, the test specimens resulting from processes that obtained higher UCS's, performed better in the UCS after immersion tests, the freeze/thaw weathering tests, and the wet/dry weathering tests. Permeability had little effect on the performance of the test specimens during the physical testing. Author

N92-20111# Environmental Protection Agency, Cincinnati, OH. Risk Reduction Engineering Lab.
COMPARISON OF SOLIDIFICATION/STABILIZATION PROCESSES FOR TREATMENT OF MUNICIPAL WASTE COMBUSTION RESIDUES. PART 2: LEACHING PROPERTIES. PROCEEDINGS OF THE MUNICIPAL WASTE COMBUSTION SYMPOSIUM
D. S. Kosson, H. vanderSloot, T. T. Holmes, and C. C. Wiles 1991 17 p Symposium held in Tampa, FL, 15-19 Apr. 1991 Prepared in cooperation with Rutgers-The State Univ., Piscataway, NJ; Netherlands Energy Research Foundation, Petten; and Army Engineer Waterways Experiment Station, Vicksburg, MS Submited for publication
(PB92-121201; EPA/600/D-91/254) Avail: NTIS HC/MF A03 CSCL 13B

Increasing reliance on municipal combustion (MWC) for disposal of solid waste has focused concern on management of MWC residues. A key consideration in resolving these issues is the release of contaminants from MWC residues to the environment and the effectiveness of treatment and utilization techniques to minimize contaminant release. Leaching has been identified as the most important contaminant release mechanism from MWC residues to the environment. To address these issues and others, USEPA initiated the Municipal (Waste) Innovative Technology Evaluation Program (MITE). Technology evaluation under the program includes extensive testing of the physical, chemical, and leaching properties of untreated and treated MWC residues. An overview is presented of significant results from the chemical and leaching tests carried out under the program for five solidification and/or stabilization processes. Author

N92-20114# Pacific Northwest Lab., Richland, WA.
A COMPARISON OF POLICIES TO MITIGATE US GREENHOUSE GAS EMISSIONS
J. A. Edmonds, S. C. McDonald, and R. A. Bradley (Department of Energy, Washington, DC.) Jul. 1991 12 p Presented at the 14th International Conference of the International Association of Energy Economists: Energy Developments in the 1990's-Challenges Facing the Global/Pacific Markets, Honolulu, HI, 8-10 Jul. 1991
(Contract DE-AC06-76RL-01830)
(DE92-005453; PNL-SA-19137; CONF-910764-1) Avail: NTIS HC/MF A03

The Congress of the United States requested that the Secretary of Energy: Prepare a report for the Congress that comprehensively inventories the sources of carbon dioxide (CO_2) and arranges the policy options to be formulated in cooperation with the Environmental Protection Agency (including, but not limited to, energy pricing, energy efficiency requirements, alternative fuels, alternative end use, and supply technology) which would lead to a substantial reduction in CO_2 emissions. This paper summarizes work in progress to respond to the Congressional request. Further, it builds on the DOE's first National Energy Strategy (NES) (DOE 191). As a result of the substantial research effort in support of this report, five major conclusions are drawn and discussed. DOE

N92-20119# Pacific Northwest Lab., Richland, WA.
PRECIPITATION SCAVENGING MODELS: SENSITIVITIES, TESTS, AND APPLICATIONS
J. M. Hales Jul. 1991 13 p Presented at the 5th International Conference on Precipitation Scavenging and Atmosphere Surface Exchange Process, Richland, WA, 15-19 Jul. 1991
(Contract DE-AC06-76RL-01830)

(DE92-006505; PNL-SA-19824; CONF-9107104-20) Avail: NTIS HC/MF A03

'Multiphase' atmospheric chemistry models can be described as atmospheric pollutant simulations that explicitly differentiate between physical phases in the atmosphere (e.g., gas, cloud water, rain water, snow,...), and directly compute chemical transport and transformation behavior between and within each of these individual phases. Initially formulated for specific application to precipitation-scavenging analysis, many attributes of these models have become incorporated into the more general atmospheric chemisty codes as well. During the past few years, several of these multiphase precipitation scavenging models have been developed to the point where they can be applied, in a moderately straightforward fashion, by members of the extended atmospheric sciences community. This presentation provides a brief overview of several aspects of a number of these models, including their structure, their application, their sensitivities and uncertainty levels, their evaluation against field measurements, and their availability. DOE

N92-20200# Oak Ridge National Lab., TN.

ATMOSPHERIC DEPOSITION, FOREST NUTRIENT STATUS, AND FOREST DECLINE: IMPLICATIONS OF THE INTEGRATED FOREST STUDY

Dale W. Johnson (Nevada Univ., Reno.), Steven E. Lindberg, Helga VanMiegroet, Gary M. Lovett, Dale W. Cole, Myron J. Mitchell, and Dan Binkley 1991 23 p Presented at the Conference on Forest Decline in the Atlantic and Pacific Region, Hilo, HI, 2-6 Jun. 1991

(Contract DE-AC05-84OR-21400)

(DE92-005101; CONF-9106320-1) Avail: NTIS HC/MF A03

The results of the Integrated Forest Study, an analysis of the effects of atmospheric deposition on the nutrient cycles of 21 sites in the US, Canada, and Norway, are reviewed. Atmospheric deposition was greatest in the high elevation sites in the southeastern US (Smoky Mountains) and lowest in the relatively unpolluted sites in the Northwestern US. Dry and/or cloudwater deposition accounted for a considerable proportion of total deposition in all sites. With the possible exception of high elevation sites in the southeastern US, deposition of acidity poses little potential for depleting foliar cation pools, and ozone exposure had little effect on canopy leaching. Atmospherically deposited sulfur and nitrogen were studied as were short and long term retention and leaching. The only possible connection between atmospheric deposition and forest decline was in red spruce sites in the Smoky Mountains, where nitrate pulses causes soil soluble Al to reach levels known to cause reduced base cation uptake and changes in root morphology. There was no evidence of nutritional causes in the declining forest of Whiteface Mountain, N.Y. DOE

N92-20207# AQUA TERRA Consultants, Mountain View, CA.

MODELING OF NONPOINT SOURCE WATER QUALITY IN URBAN AND NON-URBAN AREAS

Anthony S. Donigian, Jr. and Wayne C. Huber (Florida Univ., Gainesville.) Jun. 1991 80 p

(Contract EPA-68-03-3513)

(PB92-109115; EPA/600/3-91/039) Avail: NTIS HC/MF A05 CSCL 13B

Nonpoint source assessment procedures and modeling techniques are reviewed and discussed for both urban and nonurban land areas. Detailed reviews of specific methodologies and models are presented, along with overview discussions focusing on urban methods and models, and on nonurban (primarily agricultural) methods and models. Simple procedures, such as constant concentration, regression, statistical, and loading function approaches are described, along with complex models such as SWMM, HSPF, STORM, CREAMS, SWRRB, and others. Brief case studies of ongoing and recently completed modeling efforts are described. Recommendations for nonpoint runoff quality modeling are presented to elucidate expected directions of future modeling efforts. Author

N92-20224# National Oceanographic Data Center, Washington, DC.

GUIDE TO MARINE POLLUTION RELATED DATA COLLECTED BY FEDERALLY SPONSORED PROJECTS IDENTIFIED IN THE FY 1984-1987 NATIONAL MARINE POLLUTION PROGRAM CATALOGS

Aug. 1991 120 p

(PB92-112051) Avail: NTIS HC/MF A06 CSCL 13B

Section 8 of the National Ocean Pollution Planning Act or 1978 mandates that the results of Federally sponsored marine pollution programs be disseminated to all interested persons. In an effort to fulfill NOAA's responsibility under section 8 of the Act, the Central Coordination and Referral Office (CCRO) of the Ocean Pollution Data and Information Network (OPDIN) has compiled summary descriptions of 98 projects described in the annual Summary of Federal Programs and Projects published for fiscal years 1984 through 1987 that have collected pollution related measurements in the marine or Great Lakes environment. Author

N92-20225# ManTech Environmental Technology, Inc., Corvallis, OR.

WORKSHOP PROCEEDINGS: THE ROLE OF CREATED AND NATURAL WETLANDS IN CONTROLLING NONPOINT SOURCE POLLUTION

Richard K. Olson, ed. and Kay Marshall, ed. (Technical Resources, Inc., Rockville, MD.) Nov. 1991 276 p Workshop held in Arlington, VA, 10-11 Jun. 1991

(Contracts EPA-68-C8-0006; EPA-68-C0-0021)

(PB92-113463; EPA/600/9-91/042) Avail: NTIS HC/MF A13 CSCL 13B

Nonpoint sources (NPS) pollution control and wetlands protection are two overlapping scientific and policy issues of the U.S. EPA. Created, restored, and natural wetlands can contribute significantly to watershed water quality, but at the same time must be protected from degradation by NPS pollution. Effective use of wetlands in NPS control requires an integrated landscape approach including consideration of social, economic, and government policy issues as well as scientific knowledge. Author

N92-20255# Radian Corp., Research Triangle Park, NC.

EMISSION INVENTORY REQUIREMENTS FOR OZONE STATE IMPLEMENTATION PLANS

Mar. 1991 105 p

(Contract EPA-68-D0-0125)

(PB92-118017; EPA/450/4-91/010) Avail: NTIS HC/MF A06 CSCL 13B

The emission inventory requirements are described which are related to preparation and submission of ozone State Implementation Plans (SIPs) for those states required to revise their plans after November 15, 1990. Emission inventory requirements are addressed which are related to geographic area of coverage, point source cutoff size specifications, sources to be included, pollutants of interest, data reporting formats, documentation requirements, quality of data base, years to be addressed, and schedule for inventory submission. Author

N92-20256# Environmental Protection Agency, Research Triangle Park, NC. Atmospheric Research and Exposure Assessment Lab.

TECHNICAL ASSISTANCE DOCUMENT FOR SAMPLING AND ANALYSIS OF OZONE PRECURSORS

L. J. Purdue, D. P. Dayton, J. Rice, and J. Bursey 31 Oct. 1991 184 p Prepared in cooperation with Radian Corp., Research Triangle Park, NC

(PB92-122795; EPA/600/8-91/215) Avail: NTIS HC/MF A09 CSCL 13B

Guidance and discussion is presented on methods applicable to the proposed revisions to Title 40 Part 58 of the Code of Federal Regulations. The proposed revisions pertain to the enhanced monitoring of ozone precursors and meteorological monitoring. The precursors addressed include volatile organic

compounds, carbonyl compounds, oxides of nitrogen, and total reactive oxides of nitrogen. The meteorological parameters include surface meteorology and upper air meteorology. Author

N92-20260# Economic Research Service, Washington, DC. Resources and Technology Div.
CLIMATE CHANGE: ECONOMIC IMPLICATIONS FOR WORLD AGRICULTURE
S. Kane, J. Reilly, and J. Tobey Oct. 1991 28 p
(PB92-128636; USDA/AER-647) Avail: NTIS HC/MF A03
CSCL 13B

Agricultural activities contribute to global climate change, and crop production will be affected if and when climate changes. Despite substantial yield effects of climate change, the economic effect on national and world economies is estimated to be small, as reduced production potential in some areas is balanced by gains in others. A slight increase in world output and a decline in commodity prices are estimated under a moderate climate change impact scenario. There remain major uncertainties in estimating future emission of greenhouse gases that contribute to climate change, costs of controlling climate change, and the effects of climate change on society. Author

N92-20299# Pacific Northwest Lab., Richland, WA.
THE EMEFS MODEL EVALUATION
W. R. Barchet, R. L. Dennis, S. K. Seilkop, and C. M. Banic Dec. 1991 137 p
(Contract DE-AC06-76RL-01830)
(DE92-005043; PNL-7914) Avail: NTIS HC/MF A07

The binational Eulerian Model Evaluation Field Study (EMEFS) consisted of several coordinated data gathering and model evaluation activities. In the EMEFS, data were collected by five air and precipitation monitoring networks between June 1988 and June 1990. Model evaluation is continuing. This interim report summarizes the progress made in the evaluation of the Regional Acid Deposition Model (RADM) and the Acid Deposition and Oxidant Model (ADOM) through the December 1990 completion of a State of Science and Technology report on model evaluation for the National Acid Precipitation Assessment Program (NAPAP). Because various assessment applications of RADM had to be evaluated for NAPAP, the report emphasizes the RADM component of the evaluation. A protocol for the evaluation was developed by the model evaluation team and defined the observed and predicted values to be used and the methods by which the observed and predicted values were to be compared. Scatter plots and time series of predicted and observed values were used to present the comparisons graphically. Difference statistics and correlations were used to quantify model performance. DOE

N92-20333# Environmental Protection Agency, Research Triangle Park, NC. Atmospheric Research and Exposure Assessment Lab.
US STANDARDS FOR AIR SAMPLING OF ENVIRONMENTAL CONTAMINANTS: CURRENT BASIS AND FUTURE OPTIONS
W. J. Mitchell Oct. 1991 11 p Presented at the International Symposium on Air Sampling Instrument Performance, Research Triangle Park, NC, 29-31 Oct. 1991
(PB92-121219; EPA/600/D-91/255) Avail: NTIS HC/MF A03
CSCL 13B

EPA's initial approach to reduce the exposure of the population to the 189 hazardous air pollutants (HAPS) identified in the 1990 Clean Air Act Amendments (CAAA) involves voluntary reductions in the release of the HAPS to the atmosphere by manufacturers and users of the HAPS. Later, EPA plans to specify engineering based control requirements on these manufacturers and users of HAPS. The above approach differs markedly from the control with compliance approach that EPA used in the 1970's to reduce the exposure of the population to the six criteria pollutants (CO, NO2, SO2, O3, particles and PB). Why this difference occurred is described and opportunities are identified that the current approach provides to those who develop, manufacture, or install stack gas monitoring equipment, and those who serve as consultants in pollution control matters. Five emerging issues are identified which are addressed in the CAAA of 1990 and how suppliers of pollutant monitoring equipment can assist EPA in addressing these issues. Author

N92-20340# National Oceanic and Atmospheric Administration, Research Triangle Park, NC. Atmospheric Sciences Modeling Div.
REGIONAL AIR QUALITY AND ACID DEPOSITION MODELING AND THE ROLE FOR VISUALIZATION
J. H. Novak and R. L. Dennis Nov. 1991 11 p
(Grant EPA-R-814854)
(PB92-124247; EPA/600/D-91/274) Avail: NTIS HC/MF A03
CSCL 13B

The U.S. Environmental Protection Agency (EPA) uses air quality and deposition models to advance the scientific understanding of basic physical and chemical processes related to air pollution, and to assess the effectiveness of alternative emissions control strategies. This paper provides a brief technical description of several regional scale atmospheric models, their current use within the EPA, and related data analysis issues. Spatial analysis is a key component in the evaluation and interpretation of the model predictions. Thus, the authors highlight several types of analysis enhancements focusing on those related to issues of spatial scale, user access to models and analysis tools, and consolidation of air quality modeling and graphical analysis capabilities. They discuss their initial experience with a Geographical Information System (GIS) pilot project that generated the initial concepts for the design of an integrated modeling and analysis environment. Finally, they present current plans to evolve this modeling/visualization approach to a distributed, heterogeneous computing environment which enables any research scientist or policy analyst to use high performance visualization techniques from their desktop. GRA

N92-20351# Pacific Northwest Lab., Richland, WA.
SCAVENGING RATIOS BASED ON INFLOW AIR CONCENTRATIONS
W. E. Davis, M. T. Dana, R. N. Lee, W. G. N. Slinn, and J. M. Thorp Jul. 1991 13 p Presented at the 5th International Conference on Precipitation Scavenging and Atmosphere Surface Exchange Process, Richland, WA, 15-19 Jul. 1991
(Contract DE-AC06-76RL-01830)
(DE92-002147; PNL-SA-20055; CONF-9107104-17) Avail: NTIS HC/MF A03

Scavenging ratios were calculated from field measurements made during April 1985. Event precipitation samples were collected at the surface, but air chemistry measurements in the air mass feeding the precipitation were made from an aircraft. In contrast, ratios calculated in previous studies have used air concentration and precipitation chemistry data from only surface measurements. Average scavenging ratios were calculated for SO4(exp 2-), NO3(-), NH4(+), total sulfate, total nitrate, and total ammonium for 5 events; the geometric mean of these scavenging ratios were 8.5 x 10(exp 5), 5.6 x 10(exp 6), 4.3 x 10(exp 5), 3.4 x 10(exp 5), 2.4 x 10(exp 6), and 9.7 x 10(exp 4), respectively. These means are similar to but less variable than previous ratios formed using only surface data. DOE

N92-20398# National Oceanic and Atmospheric Administration, Research Triangle Park, NC. Atmospheric Sciences Modeling Div.
ROUTINE ESTIMATION AND REPORTING OF DRY DEPOSITION FOR THE U.S.A. DRY DEPOSITION NETWORK
J. F. Clarke, E. Edgerton, and R. P. Boksleitner 1991 14 p Prepared in cooperation with Environmental Science and Engineering, Inc., Durham, NC
(Contract EPA-68-D8-0016)
(PB92-121144; EPA/600/D-91/248) Avail: NTIS HC/MF A03
CSCL 13B

A National Dry Deposition Network (NDDN) was established in the U.S. during 1986 to document the magnitude, spatial variability, and trends in dry deposition of ozone and acidic particles and gases. Currently, the network consists of 50 stations: 41 in the

eastern U.S. and 9 in the western U.S. Dry deposition is not measured directly in the NDDN, but is estimated by an inferential approach, i.e., fluxes are calculated as the product of measured ambient concentration and modeled deposition velocity. The temporal resolution for the dry deposition calculations is weekly. Chemical species include ozone, sulfate, nitrate, ammonium, sulfur dioxide, and nitric acid. Preliminary dry deposition calculations yielded the following observations: (1) calculated values of dry deposition for colocated sites are in good agreement suggesting good network precision; and (2) spatial patterns of SO2 and HNO3 dry deposition are consistent with emission patterns. Author

N92-20402# Oak Ridge National Lab., TN.
IMPLEMENTATION OF THE NATURAL RESOURCE DAMAGE ASSESSMENT RULE
Nov. 1991 43 p
(Contract DE-AC05-84OR-21400)
(DE92-005286; ES/ER/TM-24) Avail: NTIS HC/MF A03

Regulations have been promulgated by the Department of Interior (DOI) which provide an administrative process whereby natural resource trustees may establish the type and extent of injury and evaluate the damages to natural resources. These regulations provide an optional mechanism for Natural Resource Damage Assessments (NRDAs), with four major components. A workshop was held to develop recommendations for DOE-OR regarding implementation of the DOI NRDA regulations at the Oak Ridge Reservation (ORR). The attendants were divided into three working groups to consider (1) administrative/legal requirements, (2) ecological assessments, and (3) the NRDA/economic evaluation process. This report supplies an overview of the DOI NRDA regulations as well as summaries of the consensus of each of the three working groups. DOE

N92-20424# Lawrence Livermore National Lab., CA. Atmospheric and Geophysical Sciences Div.
TROPOSPHERIC NITROGEN: THE INFLUENCE OF ANTHROPOGENIC SOURCES ON DISTRIBUTION AND DEPOSITION Report, Jul. 1989 - Jul. 1990
J. E. Penner, C. S. Atherton, and J. J. Walton Dec. 1991 119 p
(PB92-126937; EPA/600/3-91/070) Avail: NTIS HC/MF A06 CSCL 13B

A general circulation model is used to provide three-dimensional global wind, vertical convective mass transport, and precipitation fields for modeling the transport of reactive nitrogen and its removal by precipitation. Major sources of NO(sub x) include lightning, soil microbial activity, oxidation of N2O in the stratosphere and its transport to the troposphere, fossil-fuel combustion, and biomass burning. In the modeling study, a simplified approach for the atmospheric chemistry of NO(sub x) and its conversion to HNO3 is used. The gas-phase concentrations of NO(sub x) and HNO3 throughout the troposphere as well as the deposition of nitrate in precipitation and dry deposition are determined for January and July. Model predictions of NO(sub x), HNO3, and NO3(-) concentrations in precipitation are compared to measured abundances as well as predictions of surface NO(sub x) and HNO3 concentrations. The model is used to treat three situations: only fossil-fuel sources, only natural sources, and all sources in order to discern the contribution of various sources to the observed and predicted abundances. Information about the source and deposition amounts are combined to create regional net nitrogen mass balances, thereby illustrating which regions and sources contribute to increased nitrogen deposition. GRA

N92-20439# Environmental Protection Agency, Research Triangle Park, NC. Environmental Criteria and Assessment Office.
INDOOR AIR ASSESSMENT: A REVIEW OF INDOOR AIR QUALITY RISK CHARACTERIZATION STUDIES
Mar. 1991 117 p
(PB92-109107; EPA/600/8-90/044; ECAO-R-0314) Avail: NTIS HC/MF A06 CSCL 13B

Risk assessment methodologies provide a mechanism for incorporating scientific evidence and judgements into the risk management decision process. A risk characterization framework was developed to provide a systematic approach for analysis and presentation of risk characterization study results. The framework was used as a tool to review published studies that provide quantitative risk estimates associated with exposure to indoor air pollutants. Comparisons of both the methods and the resulting risk estimates are presented. Critical assumptions concerning risk estimates and exposure estimates for each study are recorded on the framework. Fourteen risk characterization studies were reviewed including three studies for radon, six for environmental tobacco smoke, three for volatile organics, one for formaldehyde only, and one for asbestos. The quality and rigor of analysis varied greatly among the studies reviewed. Some of the studies clearly state that they are intended to be preliminary analyses or screening studies, others are reported as sensitivity analyses, and others are detailed risk assessments. Studies which are technically rigorous in some risk components are often less rigorous in other components. Author

N92-20441# Environmental Protection Agency, Research Triangle Park, NC. Atmospheric Research and Exposure Assessment Lab.
IMPACT OF METHANOL AND CNG FUELS ON MOTOR VEHICLE TOXIC EMISSIONS
F. Black and P. Gabele 1991 19 p
(PB92-110378; EPA/600/D-91/240) Avail: NTIS HC/MF A03 CSCL 13B

The 1990 Clear Air Act Amendments require that the EPA study the need for reduction of motor vehicle toxic emissions such as formaldehyde, acetaldehyde, benzene, 1,3-butadiene, and polycyclic organic matter. Toxic organic emissions can be reduced by using the control technologies used for regulated THC (NMHC) and CO emissions, and by changing fuel composition. Emissions associated with the use of methanol and compressed natural gas fuels are examined. Both tailpipe and evaporative emissions are examined at varied ambient temperatures ranging from 20 C to 105 F. Tailpipe emissions are also examined over a variety of driving cycles with average speeds ranging from 7 to 48 mph. Results suggest that at equivalent ambient temperatures and average speeds, motor vehicle toxic emissions are generally reduced with methanol and compressed natural gas (CNG) fuel relative to those with gasoline, except for formaldehyde emissions, which may be elevated. As with gasoline, tailpipe toxic emissions with methanol and compressed natural gas fuels generally increase when ambient temperature or average speed decreases. Evaporative emissions generally increase when fuel volatility or ambient temperature increases. Author

N92-20444# Radian Corp., Research Triangle Park, NC.
NATIONAL AIR TOXICS INFORMATION CLEARINGHOUSE: BIBLIOGRAPHY OF SELECTED REPORTS AND FEDERAL REGISTER NOTICES RELATED TO AIR TOXICS. VOLUME 5: CITATIONS, 1991 Final Interim Report
C. A. Owen, L. Y. Cooper, L. C. Huff, V. J. McDonald, and J. S. McLean Jul. 1991 207 p
(Contract EPA-68-D8-0065)
(PB92-111830; DCN-91-203-099-37-06; EPA/450/3-91/016)
Avail: NTIS HC/MF A10 CSCL 13B

The National Air Toxics Information Clearinghouse was established by the EPA's Office of Air Quality Planning and Standards for the purpose of facilitating information transfer among Federal, State, and local air quality management agencies. State and local agencies and other Clearinghouse users are provided with bibliographic citations of reports and Federal Register notices useful in developing and operating air toxics control programs. The bibliography is published in five volumes plus an index. Volume 5 contains the more recent citations from January 1990 to January 1991. Section 1 includes introductory material describing the bibliography scope and organization and contains information necessary for the proper use of the document. Section 2 contains the report and Federal Register notice entries with bibliographic information and, in most cases, an abstract. The current index to

the bibliography covers all the reports from 1974 to the present. Author

N92-20445# Radian Corp., Research Triangle Park, NC.
NATIONAL AIR TOXICS INFORMATION CLEARINGHOUSE: ONGOING RESEARCH AND REGULATORY DEVELOPMENT PROJECTS Final Interim Report
L. Y. Cooper, L. C. Huff, V. J. McDonald, and J. S. McLean Jul. 1991 207 p
(Contract EPA-68-D8-0065)
(PB92-111905; DCN-91-203-099-37-07; EPA/450/3-91/015)
Avail: NTIS HC/MF A10 CSCL 13B

The National Air Toxics Information Clearinghouse was established by the EPA's Office of Air Quality Planning and Standards for the purpose of facilitating information transfer among Federal, State, and local air quality management agencies. State and local agencies and other Clearinghouse users are informed of U.S. EPA, National Institute for Occupational Safety and Health (NIOSH), Agency for Toxic Substances and Disease Registry (ATSDR), and State and local agency research and regulatory development projects concerning toxic air pollutants. In the introduction, the document's scope and use is explained. Next, 269 air toxics projects are listed which were in progress as of March 31, 1991, at EPA, NIOSH, ATSDR, and State and local agencies. An index is presented that allows the reader to locate projects of interest. The appendix lists regulatory development projects on toxic chemicals under way at the EPA's Office of Drinking Water (ODW). Although most of these projects are not directly related to air problems, health information on toxic chemicals from ODW projects may be of interest to Clearinghouse users. Author

N92-20446# Radian Corp., Research Triangle Park, NC.
NATIONAL AIR TOXICS INFORMATION CLEARINGHOUSE: BIBLIOGRAPHY OF SELECTED REPORTS AND FEDERAL REGISTER NOTICES RELATED TO AIR TOXICS. INDEX, 1991 Final Interim Report
C. A. Owen, L. Y. Cooper, L. C. Huff, V. J. McDonald, and J. S. McLean Jul. 1991 487 p
(Contract EPA-68-D8-0065)
(PB92-111913; DCN-91-203-099-37-08; EPA/450/3-91/017)
Avail: NTIS HC/MF A21 CSCL 13B

The National Air Toxics Information Clearinghouse was established by the EPA Office of Air Quality Planning and Standards for the purpose of facilitating information transfer among Federal, State, and local air quality management agencies. State and local agencies and other Clearinghouse users are provided with bibliographic citations of reports and Federal Register notices useful in developing and operating air toxics control programs. The bibliography is published in five volumes plus an index. The index to the bibliography covers all the reports from 1974 to the present. Under each keyword, report titles are listed for which the keyword has been assigned. Each listing indicates which of the five volumes contains the citation and is followed by an alphanumerical identifier. The identifier is used to locate the citation in the bibliography that is organized in alphabetic, then numeric order in each volume. The current index is organized by document type; by pollutant class, name, or CAS number; by source category SIC Code; and by sponsoring agency. Author

N92-20466# Northeastern Forest Experiment Station, Radnor, PA.
SCREENING PROCEDURE TO EVALUATE EFFECTS OF AIR POLLUTION ON EASTERN REGION WILDERNESSES CITED AS CLASS 1 AIR QUALITY AREAS
M. B. Adams, D. S. Nichols, C. A. Federer, K. F. Jensen, and H. Parrott Sep. 1991 38 p
(PB92-101567; FSGTR-NE-151) Avail: NTIS HC/MF A03 CSCL 13B

The U.S. Department of Agriculture Forest Service's Eastern Region manages eight wilderness areas that have been designated as Class 1 air quality areas by the Federal Clean Air Act. As part of the legislation, Federal land managers are required to consult with air pollution regulators on the potential impacts of proposed air pollution emissions on the air quality-related values (AQRV) of these wilderness areas. An interim procedure for screening applications for prevention of significant deterioration permits required for Class 1 areas is discussed, and the AQRV's for the eight Eastern Region wilderness areas are described. Author

N92-20476# Clayton Environmental Consultants, Inc., Novi, MI.
SAMPLING AND ANALYSIS OF GASES AND VAPORS
M. A. Coffman and J. Singh Aug. 1991 25 p Sponsored by National Inst. for Occupational Safety and Health, Cincinnati, OH
(PB92-114636) Avail: NTIS HC/MF A03 CSCL 13B

Techniques which were available to the industrial hygienist for evaluating exposures to gases and vapors in the work environment were described. The applications and limitations of several sampling media and techniques were presented. General sampling considerations discussed included sampling strategies, and operational limits of sampling and analysis. Sampling media for gases and vapors included solid sorbents, passive samplers, and flexible plastic bags/partially evacuated rigid containers. Desorption of contaminants and collection efficiency of solid sorbents were also discussed. Analytical techniques considered include gas chromatography, flame ionization detector, nitrogen/phosphorus detector, photoionization detector, high performance liquid chromatography, gas chromatography/mass spectrometry, volumetric methods, and ion chromatography. Quality assurance was discussed. GRA

N92-20478# Metcalf and Eddy, Inc., Wakefield, MA.
STABILIZATION TECHNOLOGIES FOR RCRA CORRECTIVE ACTIONS: HANDBOOK
Aug. 1991 75 p Prepared in cooperation with Eastern Research Group, Inc., Arlington, MA
(Contract EPA-68-CO-0068)
(PB92-114495; EPA/625/6-91/026) Avail: NTIS HC/MF A04 CSCL 13B

Several technologies are available for stabilizing contaminant sources for corrective action sites. Innovative technologies such as horizontal well drilling and bioremediation are discussed. GRA

N92-20481# Eastern Research Group, Inc., Arlington, MA.
PROCEEDINGS OF THE U.S. EPA MUNICIPAL WASTEWATER TREATMENT TECHNOLOGY FORUM
Sep. 1991 266 p Forum held in Portland, OR, 5-7 Jun. 1991
(Contract EPA-68-C1-0018)
(PB92-116060; EPA/430/09-91/020) Avail: NTIS HC/MF A12 CSCL 13B

The publication contains the results of the 1991 Municipal Wastewater Technology Forum. The forum provided the opportunity for wastewater treatment professionals, (Federal and State governments) to discuss wastewater technology development and transfer issues. Subjects covered are: land treatment, sand and gravel filters, operations and maintenance, biological nutrients, etc. GRA

N92-20483# Eastern Research Group, Inc., Arlington, MA.
WORKSHOP REPORT ON TOXICITY EQUIVALENCY FACTORS FOR POLYCHLORINATED BIPHENYL CONGENERS: RISK ASSESSMENT FORUM
Jun. 1991 97 p Workshop held in Washington, DC, 11-12 Dec. 1990
(Contract EPA-68-C8-0036)
(PB92-114529; EPA/625/3-91/020) Avail: NTIS HC/MF A05 CSCL 13B

The purpose of the workshop was to examine the existing toxicity and exposure database on polychlorinated biphenyls (PCBs) to ascertain the feasibility of developing toxicity equivalency factors (TEFs) for PCB congeners. Given the widespread acceptance and acknowledged utility of the TEF method for assessing risks associated with exposures to complex mixtures of chlorinated dibenzo-p-dioxins and dibenzofurans, some experts have urged the development of comparable TEF schemes for other structurally

related chemicals, such as PCBs. Information from the workshop will contribute to Risk Assessment Forum recommendations on whether to pursue development of a TEF scheme for PCBs.
GRA

N92-20526*# Purdue Univ., West Lafayette, IN. Dept. of Earth and Atmospheric Sciences.
THE ROLE OF GLOBAL CLOUD CLIMATOLOGIES IN VALIDATING NUMERICAL MODELS Semiannual Report, 1 Oct. 1991 - 31 Mar. 1992
Harshvardhan 1992 57 p Submitted for publication
(Grant NAG5-1125)
(NASA-CR-190165; NAS 1.26:190165) Avail: NTIS HC/MF A04 CSCL 13B

Global maps of the monthly mean net upward longwave radiation flux at the ocean surface were obtained for April, July, October 1985 and January 1986. These maps were produced by blending information obtained from a combination of general circulation model cloud radiative forcing fields, the top of the atmosphere cloud radiative forcing from ERBE and TOVS profiles and sea surface temperature on ISCCP C1 tapes. The fields are compatible with known meteorological regimes of atmospheric water vapor content and cloudiness. There is a vast area of high net upward longwave radiation flux (greater than 80/sq Wm) in the eastern Pacific Ocean throughout most of the year. Areas of low net upward longwave radiation flux ((less than 40/sq Wm) are the tropical convective regions and extra tropical regions that tend to have persistent low cloud cover.The technique used relies on General Circulation Model simulations and so is subject to some of the uncertainties associated with the model. However, all input information regarding temperature, moisture, and cloud cover is from satellite data having near global coverage. This feature of the procedure alone warrants its consideration for further use in compiling global maps of longwave radiation. Author

N92-20540# International Bank for Reconstruction and Development, Washington, DC.
ENVIRONMENTAL CHALLENGE
B. Conable, J. Warford, Z. Partow, E. Lutz, and M. Munasinghe Sep. 1991 33 p
(PB91-240267) Avail: NTIS MF A03; HC available from World Bank Publications, PO Box 7247-8619, Philadelphia, PA CSCL 13B

A collection of 11 articles on the environment is presented by the World Bank. Each article deals with a specific environmental problem and explains the World Bank's efforts and policies towards these problems. Also included is a history of the World Bank's environmental policies and how they have changed in recent years. The articles presented are titled: (1) Development and the Environment: A Global Balance; (2) Evolution of the World Bank's Environmental Policy; (3) Accounting for the Environment; (4) Public Policy and the Environment; (5) Managing Drylands; (6) Environmental Action Plans in Africa; (7) Agroforestry in Sub-Saharan Africa; (8) Irrigation and the Environmental Challenge; (9) Curbing Pollution in Developing Countries; (10) Global Warming and the Developing World; and (11) The Global Environment Facility. GRA

N92-20543# Oak Ridge National Lab., TN.
ENVIRONMENTAL SURVEILLANCE DATA REPORT FOR THE FOURTH QUARTER OF 1990
P. Y. Goldberg, B. M. Horwedel, R. S. Loffman, A. E. Osborne-Lee, M. R. Powell, M. M. Stevens, M. F. Tardiff, C. K. Valentine, and D. A. Wolf Jan. 1992 129 p
(Contract DE-AC05-84OR-21400)
(DE92-005089; ORNL/M-1157) Avail: NTIS HC/MF A07

The Environmental Surveillance and Protection Section within the Office of Environmental and Health Protection at the Oak Ridge National Laboratory (ORNL) is responsible for the development and implementation of an environmental program to (1) ensure compliance with all federal, state, and Department of Energy (DOE) reporting requirements to quantitatively demonstrate prevention, control, and abatement of environmental pollution; (2) monitor the adequacy of containment and effluent controls; and (3) assess impacts of releases from ORNL facilities on the environment. Environmental monitoring, as defined by Draft DOE Order 5400.6, consists of two major activities: effluent monitoring and environmental surveillance. Effluent monitoring is the collection and analysis of sample or measurements of liquid and gaseous effluents. Environmental surveillance is the collection and analysis of samples, or direct measurements, of air, water, soil, foodstuff, biota, and other media from DOE sites and their environs. Monthly or quarterly summaries are presented in this report for each media sampled. All data are rounded to two significant digits. The summary tables generally give the number of samples collected during the period and the maximum, minimum, average, and standard error of the mean (SE) values of parameters for which determinations were made. DOE

N92-20574# Rolls-Royce Ltd., Derby (England).
THE ENVIRONMENTAL IMPACT OF COMMERCIAL AVIATION: THE EVOLUTION OF EXHAUST EMISSIONS LEGISLATION AND CONTROL TECHNOLOGY
G. Pilkington and A. B. Wassell 14 Apr. 1991 8 p
(PNR-90847; ETN-92-90797) Copyright Avail: NTIS HC/MF A02

Interest in the environmental impact of turbine powered aircraft was kindled in the early 1960s by the black smoke trails emanating from engines that also emitted the characteristic high noise levels of high velocity exhaust jets. The introduction of more powerful engines, jet mixing, and combustors with leaner primary zones occurred in parallel with the development of the first environmental legislation towards the end of the decade. The 1970s were characterized by the introduction of the high ratio engines with low noise levels and invisible exhausts. Attention was then turned to the invisible exhaust emissions and initial estimates were made of their effect on the environment. This activity resulted in international guidelines for both noise and emissions by 1981. All commercial aircraft engines currently being produced now meet these standards and discussions have started to see whether these standards are still appropriate for the start of the next century or whether more stringent standards should be considered. ESA

N92-20647# General Accounting Office, Washington, DC.
GREENHOUSE EFFECT: DOE'S PROGRAMS AND ACTIVITIES RELEVANT TO THE GLOBAL WARMING PHENOMENON
Mar. 1990 51 p
(GAO/RCED-90-74BR; B-237780) Avail: NTIS HC/MF A04; also available from GAO, PO Box 6015, Gaithersburg, MD 20877 HC first five copies free, additional copies $2.00

Background information is given on the global warming issue as well as the Department of Energy's (DOE's) objectives, scope, and methodology in relation to the problem. Details are given on DOE's policies and research efforts. Examples of energy policy and program changes to mitigate the global warming phenomenon that have been suggested by various Federal and non-Federal authorities are provided. Appendices include descriptions of DOE program areas relevant to the global climate change issue, additional information on suggested energy policy and program changes to address global warming, and a list of major contributors to this briefing report. Information is given in tabular form on DOE's FY 1989 budget and 1990 budget request for direct and indirect programs relevant to global climate change. Author

N92-20702# Environmental Protection Agency, Research Triangle Park, NC. Office of Air Quality Planning and Standards.
COMPILATION OF AIR POLLUTANT EMISSION FACTORS. VOLUME 1: STATIONARY POINT AND AREA SOURCES, 4TH EDITION, SUPPLEMENT D
W. M. Joyner Sep. 1991 137 p
(PB92-126945; AP-42-Suppl-D) Avail: NTIS HC/MF A07 CSCL 13B

Updated and revised emissions data are presented for natural gas combustion, residential fireplaces, residential wood stoves, refuse combustion, nonindustrial surface coating, waste water collection treatment and storage, polyvinyl chloride and

polypropylene, poly(ethylene terephthalate), polystyrene, ammonium phosphates, portland cement manufacturing, sand and gravel processing, western surface coal mining, wildfire and prescribed burning, wet cooling towers, and industrial flares.
GRA

N92-20817# Kerr (Robert S.) Environmental Research Lab., Ada, OK.
FACILITATED TRANSPORT OF INORGANIC CONTAMINANTS IN GROUND WATER. PART 2: COLLOIDAL TRANSPORT
R. W. Puls, R. M. Powell, D. A. Clark, and C. J. Paul Jul. 1991 14 p Prepared in cooperation with ManTech Environmental Technology, Inc., Ada, OK
(PB92-114503; EPA/600/M-91/040) Avail: NTIS HC/MF A03 CSCL 13B

The project entailed both field and laboratory components. Field studies evaluated routine sampling procedures for determination of aqueous inorganic geochemistry and assessment of contaminant transport by colloidal mobility. Research at three different metal-contaminated sites showed that 0.45 micrometer filtration has not removed potentially mobile colloids, when samples were collected using low pumping flow rates (approximately 0.2-0.3 L/min). However, when pumping velocities greatly exceed formation groundwater flow velocities, large differences between filtered and unfiltered samples are observed, and neither are representative of values obtained with the low flow rate pumped samples. In controlled laboratory experiments, the stability and transport of radio-labeled Fe2O3 model colloids were studied using batch and column techniques. Variables in the study included flow rate, pH, ionic strength, electrolyte composition (anion/cation), colloid concentration, and colloid size. Iron oxide colloids in the 100-900 nm particle diameter range were not only mobile to a significant extent, but under some hydrogeochemical conditions were transported faster than a conservative tracer, tritium. Particle size and anionic composition together with particle stability provided the highest statistical correlation governing extent of colloidal transport. The rate of colloid-arsenate transport was over 21 times that of the dissolved arsenate. GRA

N92-20826# Alliance Technologies Corp., Lowell, MA.
DEVELOPMENT OF SEASONAL AND ANNUAL BIOGENIC EMISSIONS INVENTORIES FOR THE U.S. AND CANADA Final Report, Sep. 1989 - May 1991
L. G. Modica and J. R. McCutcheon Nov. 1991 147 p
(Contract EPA-68-D9-0173)
(PB92-126796; EPA/600/7-91/006) Avail: NTIS HC/MF A07 CSCL 13B

The development of a biogenic emissions inventory for the U.S. and Canada is described to assess the role of biogenic emissions in ozone formation. Emission inventories were developed at hourly and grid (1/4 x 1/6 degree) levels from input data at the same scales. Emissions were calculated as a function of biomass density and meteorological parameters (solar radiation, cloud cover, temperature, wind speed, and relative humidity). These factors were applied to a forest canopy algorithm that simulated processes generating biogenic emissions from foliage. Resultant emissions were aggregated to monthly, seasonal, and annual levels, and spatially to counties and states. (Historically, ozone control programs based on reductions of known anthropogenic volatile organic compound (VOC) emissions have had limited success in obtaining the National Ambient Air Quality Standard. Researchers have, therefore, been actively evaluating VOC emission sources not routinely considered in ozone control strategies. One potentially large source of reactive VOC's is thought to be emissions from crop and forest foliage.) Approximately 50 percent of the biogenic hydrocarbon emissions occur in the summer, approximately equal amounts (20 percent) in the spring and fall, and much lower amounts in the winter. GRA

N92-20857# Pacific Northwest Lab., Richland, WA.
A FRAMEWORK FOR EVALUATING INNOVATIVE STATISTICAL AND RISK ASSESSMENT TOOLS TO SOLVE ENVIRONMENT RESTORATION PROBLEMS
N. L. Hassig, R. O. Gilbert, and B. A. Pulsipher Sep. 1991 12 p Presented at the Environmental Remediation 1991 Conference, Pasco, WA, 8-11 Sep. 1991
(Contract DE-AC06-76RL-01830)
(DE92-004508; PNL-SA-19454; CONF-910981-49) Avail: NTIS HC/MF A03

Environmental restoration activities at the Department of Energy (DOE) Hanford site face complex issues due to a history of varied contaminant disposal practices. Data collection and analysis required for site characterization, pathway modeling, and remediation selection decisions must deal with inherent uncertainties and unique problems associated with the restoration. A framework for working through the statistical aspects of the site characterization and remediation selection problems is needed. This framework would facilitate the selection of appropriate statistical tools for solving unique aspects of the environmental restoration problem. This paper presents a framework for selecting appropriate statistical and risk assessment methods. The following points will be made: (1) pathway modelers and risk assessors often recognize that 'some types' of statistical methods are required but don't work with statisticians on tools development in the early planning phases of the project; (2) statistical tools selection and development are problem-specific and often site-specific, further indicating a need for up-front involvement of statisticians; and (3) the right tool, applied in the right way can minimize sampling costs, get as much information as possible out of the data that does exist, provide consistency and defensibility for the results, and give structure and quantitative measures to decision risks and uncertainties. DOE

N92-20928# Rolls-Royce Ltd., Derby (England).
THE ENVIRONMENTAL CHALLENGES FOR THE NEXT SUPERSONIC AIRCRAFT
M. J. T. Smith 9 Nov. 1990 6 p Presented at the Japan Society for Aeronautical and Space Sciences 28th Aircraft Symposium, Tokyo, Japan, 7-9 Nov. 1990
(PNR-90782; ETN-92-90768) Copyright Avail: NTIS HC/MF A02

Most people would accept that there will, one day, be a Second-generation Supersonic Transport (SST). At the same time, in an era of heightening environmental awareness, one can assume that there will be progressively more stringent restrictions on both exhaust emissions and noise. Indeed, because aircraft deliver all their pollutants directly to the upper atmosphere, they may come under a far more powerful microscope than land based consumers of fossil fuels. At the same time, noise, although a pollutant with far less effect in human well being, will always be a political stalking horse and, in the case of the SST, there is the added issue of the sonic boom. Hence, the next SST will be faced with more and bigger environmental hurdles than aroused the 'green' interest in the Concorde 20 years ago. Designers will have to anticipate the stringency of environmental legislation to ensure that their new SST can fly alongside subsonic contemporaries without any operational and, therefore, commercial disadvantages. The environmental regulatory situation and ways in which targets may be met are discussed. Special attention is given to exhaust emission and noise restrictions. ESA

46 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; ionospheric and magnetospheric physics; and geomagnetism.

For space radiation see *93 Space Radiation.*

N92-20270*# Texas Univ., Austin. Dept. of Geological Sciences.
STUDIES OF WATER STORAGE AND OTHER CONTRIBUTIONS TO CHANGES IN THE ROTATION OF THE EARTH Final Technical Report
Clark R. Wilson 1991 7 p

(Grant NAG5-756)
(NASA-CR-190062; NAS 1.26:190062) Avail: NTIS HC/MF A02 CSCL 08G

The effects were determined of the global redistribution of water mass on various geodetic observables, especially polar motion, and complementary observables such as geodetic satellite positions. The effect of water mass redistribution has been and continues to be less well known and more difficult to observe than effects of air mass distribution, yet the water contribution is potentially significant over a large range of periods. The current understanding is reviewed of the contribution of polar drift, decadal polar motion, Chandler and annual wobbles, and higher frequency polar motion, as determined through the efforts of the funded work within the NASA Crustal Dynamics Project, and in the context of the general literature on the subject. Water mass redistribution is either demonstrably important to the excitation of each of these, or is probably important given a lack of other likely excitation sources. Author

N92-20357 Newcastle-upon-Tyne Univ. (England).
COMPUTER AIDED DESIGN OF GEODETIC NETWORKS FOR MONITORING CRUSTAL TECTONICS Ph.D. Thesis
Martin W. Rayson 1990 233 p
Avail: Univ. Microfilms Order No. BRDX93812

Recent developments in terrestrial and space surveying techniques have led to the establishment of a number of campaigns to determine recent crustal motions. There is clearly a need to investigate methods of computer aided design of suitable measurement schemes. In order to do this, an interactive graphics program has been written. The design problem is structured in the following manner: Given the approximate coordinates of a series of survey control points and a geological/geophysical model for the region, find a suitable set of (terrestrial and/or space) measurements and a suitable manner in which to make them, in order to recover the precision and reliability of the geophysical parameters to a predetermined level. This type of network design can only be performed by mathematically modelling a variety of geological environments, and for each model a relationship between the geophysical parameters and the changes in station coordinates is established. A number of different models, including transform faults, divergent and convergent motions, faults, folds and regional rotations, have been developed. The program recognizes all of these models. A series of experiments were performed to establish the suitability of both terrestrial and space observations in monitoring the various geophysical parameters in the models. By selecting an observation scheme and appropriate geological model, various statistical methods in the program compute the usefulness of those observations in recovering the precision of the geophysical parameters for that model.
Dissert. Abstr.

N92-20364 Harvard Univ., Cambridge, MA.
A STUDY OF THE NUTATIONS OF THE EARTH Ph.D. Thesis
Bruce Allen Buffett 1991 282 p
Avail: Univ. Microfilms Order No. DA9123011

To explore the possible effects of inner and outer core dynamics on nutations, a simple model is developed consisting of a rigid mantle and inner core, and an adiabatic fluid outer core. The normal mode spectrum of this simple model reveals a number of modes that were not included in the International Astronomical Union (IAU) theory. Many of these modes are inertial waves, several of which have frequencies that fall within the tidal band and, therefore, are candidates for resonant excitation by nearby tidal forcing frequencies. The importance of inertial waves on nutations is shown to be comparable to a second class of modes that involve rotations of the solid inner core. The additional degrees of freedom associated with the rotation of an aspherical inner core give rise to two new modes that do not appear in the IAU theory. One is a prograde diurnal mode; the other is a long period inner core wobble. The second part of this thesis deals with physical processes that alter the nutations of the simple model considered above. The effects of elastic deformation are approached in a novel way by decomposing the equations of motion of a spheroidal and deformable model Earth into separate (though coupled) equations for the nutational and deformational parts of the motion. Results are used to compute the compliance parameters, which characterize the deformability of the Earth. In the first order calculation, corrections to the deformation are calculated for the omitted effects of ellipticity and rotation. The chief source of improvement between theory and observation is due to the elimination of a 0.39 mas discrepancy in the retrograde annual nutations. This out-of-phase correction is attributed to ohmic dissipation which necessarily accompanies the magnetic coupling.
Dissert. Abstr.

N92-20366 Washington Univ., Seattle.
AIR-SEA EXCHANGE OF MOMENTUM, HEAT, AND WATER VAPOR OVER WHITECAP SEA STATES Ph.D. Thesis
Janice Mary DeCosmo 1991 227 p
Avail: Univ. Microfilms Order No. DA9131637

To understand air-sea energy and mass transfer over whitecap sea states, a detailed analysis of measurements of heat, water vapor, and momentum fluxes in high wind conditions was made. These data were collected on the North Sea as part of the HEXOS (Humidity Exchange Over the Sea) Main Experiment, HEXMAX. Several modeling studies had predicted an enhancement of the air-sea heat and water vapor fluxes due to evaporation of sea spray, which would increase with increasing winds. Contrary to these predictions, the HEXMAX data reveal no increase in the sensible heat and water vapor transfer coefficients with increasing wind speed. The results indicate that any increase in water vapor flux due to evaporation of spray may be offset by a reduction in surface evaporation due to a decrease in water vapor density gradient. The HEXMAX sea surface drag coefficients increase with increasing wind speed for the range 5 to 27 m/s in good agreement with measurements at similar water depth, but are higher than those derived from open ocean depth. The variation in drag coefficient across three surface frontal systems was also examined. No clear pattern emerged. Some of the variability in the water vapor exchange coefficient for a given wind speed can be explained by a dependence on the drag coefficient. These results indicate that the water vapor flux may also vary with sea state.
Dissert. Abstr.

N92-20399 Hawaii Univ., Honolulu.
RADAR POLARIZATION STUDIES OF VOLCANIC AND IMPACT CRATERED TERRAINS ON THE EARTH, VENUS, AND THE MOON Ph.D. Thesis
Bruce Allan Campbell 1991 231 p
Avail: Univ. Microfilms Order No. DA9129665

The results of four research projects which utilized imaging radar polarization data for remote sensing of volcanic and impact cratered terrains on the Earth, Venus, and the Moon are presented. The first project is an analysis of airborne multi-polarization radar data. A technique is developed for decomposing the polarized radar echo into components attributed to quasi-specular, small-perturbation, and 'dihedral' mechanisms. The second and third projects analyze the geomorphology and radar polarization properties of deposits on two volcanoes, Sif and Gula Montes, in western Eistla Regio, Venus. These analyses utilize radar images collected at Arecibo Observatory in 1988 (spatial resolution 1 km). Changes in the radar brightness of lava flows with downslope distance from possible vents are inconsistent with trends observed for single terrestrial lava flow. This observation, coupled with evidence of multiple eruptive vents, suggests that most of the large flows in western Eistla Regio are formed by coalescence of numerous smaller flows. The third project also compares the radar polarization properties of volcanic deposits on Sif and Gula Montes to data for terrestrial lava flows and a smooth desert area. The fourth project presents a study of lunar crater rays using high-resolution (30 m) radar images collected at Haystack Observatory, and focuses on the bright ray in Mare Serenitatis and ray segments attributed to Tycho and Copernicus craters.
Dissert. Abstr.

N92-20408 Reading Univ. (England).
OBSERVATIONS OF GRAVITY WAVES AT ATMOSPHERIC FRONTS Ph.D. Thesis
Azizan B. Hj AbuSamah 1990 262 p
Avail: Univ. Microfilms Order No. BRDX92881

An observational study of pressure perturbations associated with the passage of atmospheric fronts over the British Isles using a triangular array of sensitive microbarographs reveals the preponderance of gravity wave activities in the vicinity of the surface cold front (SCF). Examination of the time series of these pressure perturbations in the frequency domain shows an enhancement for frequencies less than the local buoyancy frequency N after the passage of the SCF. The spectral analysis also shows two predominant frequency peaks usually located near N and N/2 s(exp -1). Isolating these frequencies shows that there is a systematic amplitude modulation with an amplification near the SCF and at a region 2-3 hours before and after the SCF passage. The cross-correlation analysis reveals that the gravity waves in the post SCF region propagate towards the SCF. As these waves approach the SCF, the across front component of the phase speed decreases and the direction of propagation of the wave rotates in an anticlockwise manner. It is found that a consistent description of the gravity waves can only be made if first the waves are assumed to be ducted, i.e. there is a reflecting layer aloft, and second that as these waves propagate through the frontal environment, due to the inhomogeneity, they are refracted. A number of conceptual models are then developed to account for the observed wave behavior in a frontal region. In this investigation it is shown that the stable layer associated with the frontal zone can form a good upper reflector for non-hydrostatic gravity waves. It is also argued that the slope of this layer plays an important role in the refraction of the observed gravity waves. A model of wave propagation in a wedge is then used to account for this slope. Dissert. Abstr.

N92-20643# National Center for Atmospheric Research, Boulder, CO. Atmospheric Technology Div.
WORKSHOP REVIEW: MANAGEMENT OF DATA COLLECTED IN GRAMP (GULF REGION ATMOSPHERIC MEASUREMENT PROGRAM)
D. Baumgardner and R. Friesen Aug. 1991 50 p Workshop held in Boulder, CO, 22-24 Jul. 1991 Prepared in cooperation with World Meteorological Organization, Geneva (Switzerland) Sponsored in part by NSF, Washington, DC
(PB92-105436; NCAR/TN-363+PROC) Avail: NTIS HC/MF A03 CSCL 04A

The demolition and subsequent burning of the Kuwait oil fires was a senseless act of destruction that has threatened public health, damaged the environment, and may possibly cause short or longer term changes in regional and global climate. Many nations responded to this disaster by offering aid and by rushing teams into the affected area to make measurements that would assess the impact of the fires. A workshop that was held July 24-26, 1991 at the National Center for Atmospheric Research (NCAR) to discuss a plan to gather all the atmospheric measurements that are being made in the Gulf region and make them available for general semination is summarized. The workshop was initiated by the World Meteorological Organization and co-sponosred by the National Oceanic and Atmospheric Organization. Author

N92-20881# Rice Univ., Houston, TX. Dept. of Space Physics and Astronomy.
DEVELOPMENT OF A MAGNETOSPHERIC SPECIFICATION MODEL. VOLUME 3: APPENDICES F AND G Final Report, 15 Nov. 1987 - 31 Mar. 1990
J. W. Freeman, R. A. Wolf, R. W. Spiro, G.-H. Voigt, and B. A. Hausman 30 Jun. 1991 239 p
(Contract F19628-87-K-0001)
(AD-A244461; PL-TR-91-2276-(3)-Vol-3; AD-E200821) Avail: NTIS HC/MF A11 CSCL 04/2

Rice University has developed a practical computer model that is capable of specifying electron and ion fluxes in the middle magnetosphere during geomagnetic storms. The model, called the Magnetospheric Specification Model (MSM), used ground-based and satellite data from the Space Forecast Center-Environment Data Base to establish initial and boundary conditions and to determine input parameters for the magnetic and electric field models. These input values are updated every 15 minutes, and new output fluxes are computed for the same times. The primary function of the MSM is the specification of fluxes of 1-100 KeV electrons in the geostationary orbit region. However, it is also designed to specify a broad range of additional parameters for the global ionospheric-magnetospheric system, including fluxes of 1-50 KeV ions, auroral electron precipitation and ionospheric electric fields. The model is accompanied by an application program that allows specification of fluxes at an arbitrary point in the magnetosphere within the modeling region. Consistent with its primary function, the MSM has been tested against spacecraft data for two substantial storms and has been shown to produce a good characterization of the enhancements of 40 KeV electron fluxes in the equatorial plane. The model never failed to predict high fluxes when they were observed, although it did predict high fluxes in some cases when they were not observed and it did fail to predict flux dropouts observed by the spacecraft. The MSM is ready for adaptation for use in an operational setting where the goal is real-time and retrospective specification of hazardous charged particle fluxes associated with geomagnetic storms. GRA

N92-20970# Pacific Northwest Lab., Richland, WA.
REMOTE GEOLOGIC STRUCTURAL ANALYSIS OF YUCCA FLAT
M. G. Foley, P. G. Heasler, K. A. Hoover, N. J. Rynes, R. L. Thiessen, and J. L. Alfaro (Washington State Univ., Pullman.) Dec. 1991 97 p
(Contracts DE-AC06-76RL-01830; DE-FG06-89ER-75522)
(DE92-006874; PNL-7887) Avail: NTIS HC/MF A05

The Remote Geologic Analysis (RGA) system was developed by Pacific Northwest Laboratory (PNL) to identify crustal structures that may affect seismic wave propagation from nuclear tests. Using automated methods, the RGA system identifies all valleys in a digital elevation model (DEM), fits three-dimensional vectors to valley bottoms, and catalogs all potential fracture or fault planes defined by coplanar pairs of valley vectors. The system generates a cluster hierarchy of planar features having greater-than-random density that may represent areas of anomalous topography manifesting structural control of erosional drainage development. Because RGA uses computer methods to identify zones of hypothesized control of topography, ground truth using a well-characterized test site was critical in our evaluation of RGA's characterization of inaccessible test sites for seismic verification studies. Therefore, we applied RGA to a study area centered on Yucca Flat at the Nevada Test Site (NTS) and compared our results with both mapped geology and geologic structures and with seismic yield-magnitude models. This is the final report of PNL's RGA development project for peer review within the U.S. Department of Energy Office of Arms Control (OAC) seismic-verification community. In this report, we discuss the Yucca Flat study area, the analytical basis of the RGA system and its application to Yucca Flat, the results of the analysis, and the relation of the analytical results to known topography, geology, and geologic structures. DOE

N92-21003# Westinghouse Hanford Co., Richland, WA.
GEOLOGY AND HYDROLOGY OF THE 300 AREA AND VICINITY, HANFORD SITE, SOUTH-CENTRAL WASHINGTON
D. R. Gaylord and E. P. Poeter (Colorado School of Mines, Golden.) Oct. 1991 97 p
(Contract DE-AC06-87RL-10930)
(DE92-006495; WHC-EP-0500) Avail: NTIS HC/MF A05

The following report summarizes the findings of a joint Washington State University (WSU) and Colorado School of Mines (CSM) research team that investigated the geology and hydrogeology of the 300 Area during FY 87-89. The primary goal of this research was to evaluate existing data and identify new and innovative techniques and/or methods necessary to

characterize the 300 Area geology and hydrogeology. Site characterization of the 300 Area demands the close integration of geologic and hydrogeologic research to achieve the most meaningful results. Geologic aspects of the research focused on the identification and analysis of both small- (i.e., sedimentary-textural characteristics) and large-scale (i.e., lithofacies and architectural elements) aquifer heterogeneities and on the derivation of fundamental compositional (i.e., mineralogy and geochemistry) data to assist in identification of marker beds. Hydrogeologic aspects of the research focused on identification and refinement of hydraulically significant, three-dimensional aquifer units termed hydrofacies and on preliminary inverse modeling of ground water flow in the 300 Area. Hydrofacies are fundamental units that will aid in site characterization, development of monitoring programs, and design of remedial action. Inverse modeling is used to improve estimates of the values of hydraulic parameters associated with each hydrofacies. The WSU/CSM research team identified two major shortcomings of the geologic and hydrogeologic data base for the 300 Area. First, the quality of geologic data from 300 Area drilling is far below that necessary to characterize either the geology or hydrogeology of the suprabasalt strata. Second, the limited number of field-scale aquifer tests and the veritable lack of hydraulic testing of discrete aquifer intervals greatly limit attempts to accurately identify basic hydraulic parameters such as hydraulic conductivity and/or specific yield. DOE

N92-21052# University of Southern California, Los Angeles. Center for Earth Sciences.
CSDP: THE SEISMOLOGY OF CONTINENTAL THERMAL REGIMES
K. Aki May 1991 46 p
(Contract DE-FG03-87ER-13807)
(DE92-003392; DOE/ER-13807/T3) Avail: NTIS HC/MF A03

The past year continued to be extremely productive following up two major breakthroughs made in the preceding year. One of the breakthroughs was the derivation of an integral equation for time-dependent power spectra, which unified all the existing theories on seismic scattering including the radiative transfer theory for total energy and single-multiple scattering theories based on the ray approach. We successfully applied the method to the data from the United States Geological Survey (USGS) regional seismic arrays in central California, Long Valley and Island of Hawaii, and obtained convincing results on the scattering Q(sup -1) and intrinsic Q(sup -1) in these areas for the frequency range from 1 Hz to 20 Hz. The frequency dependence of scattering Q(sup -1) is, then, interpreted in terms of random medium with continuous or discrete scatterers. The other breakthrough was the application of T-matrix formulation to the seismic scattering problem. We are currently working on two dimensional inclusions with high and low velocity contrast with the surrounding medium. In addition to the above two main lines of research, we were able to use so-called 'T-phase' observed on the Island of Hawaii to map the Q value with a good spatial resolution. The T-phase is seismic waves converted from acoustic waves propagated through the sofar channel of the ocean. We found that we can eliminate remarkably well the frequency dependent recording site effect from the T-phase amplitude using the amplification factor for coda waves, further confirming the fundamental separability of source, path and site effects for coda waves, and proving the effectiveness of stochastic modeling of high-frequency seismic waves. DOE

47 METEOROLOGY AND CLIMATOLOGY

Includes weather forecasting and modification.

N92-20123# Brookhaven National Lab., Upton, NY.
AN ARM GUIDE FOR CLIMATIC EVALUATION OF ALASKA AND NORTHERN NORTH AMERICA
R. M. Brown Jan. 1991 35 p
(Contract DE-AC02-76CH-00016)
(DE92-005374; BNL-46835) Avail: NTIS HC/MF A03

This guide presents climate data from the vast region of Alaska and northern North America. Its purpose is to assist in the selecting possible sites for the ARM Program. The data shown are of a general nature. The data represent a large area of mountain, plain, lake, forest, and tundra covered land. The majority of the data are taken from the World Survey of Climatology-Climates of North America. DOE

N92-20261# National Weather Service, Fort Worth, TX.
EXPERIMENTAL USE OF GRIDDED NGM OUTPUT AT WSFO LUBBOCK, TEXAS: AN INITIAL REPORT
D. V. Baker Nov. 1991 25 p
(PB92-107580; NOAA-TM-NWS-SR-139) Avail: NTIS HC/MF A03 CSCL 04B

Since April, 1991, the Weather Service Forecast Office (WSFO) in Lubbock has had access to selected gridded model output from the National Meteorological Centers Nested Grid Model (NGM). This report discusses the following: (1) how the data are obtained at Lubbock; (2) the software used to manipulate the information; (3) two cases where the third period of the zone forecast was updated over a fairly small area, based to a large extent on interpretation of fields obtained from the grid point output; and (4) the use of model grid point data in the upcoming Advance Weather Interactive Processing System era. GRA

N92-20263# National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
QUALITY CONTROL ALGORITHM FOR PROFILER MEASUREMENTS OF WINDS AND TEMPERATURES
B. L. Weber and D. B. Wuertz Oct. 1991 32 p
(PB92-124080; NOAA-TM-ERL-WPL-212) Avail: NTIS HC/MF A03 CSCL 04B

A description is given of a computer algorithm that was developed to control the quality of wind and radio acoustic sounding system temperature measurements from remote sensing radars. This document is a manual that gives detailed instructions on how to implement the computer program and then how to apply the algorithm to data analysis. GRA

N92-20264# National Severe Storms Forecast Center, Kansas City, MO.
VERIFICATION OF SEVERE LOCAL STORMS FORECAST ISSUED BY THE NATIONAL SEVERE STORMS FORECAST CENTER: 1990
P. W. Leftwich and R. W. Anthony Oct. 1991 17 p
(PB92-124452; NOAA-TM-NWS-NSSFC-31) Avail: NTIS HC/MF A03 CSCL 04B

The Severe Local Storms (SELS) Unit of the National Severe Storms Forecast Center routinely issues convective outlooks and severe local storm watches to delineate areas that are favorable for development of severe local storms. The report summarized verification of those forecasts that were issued during 1990. The threat of severe local storms was satisfactorily identified via the second-day outlooks. Prediction of the location of subsequent events improved in the first-day outlooks. During 1990, 94 percent of the tornado-related fatalities and 91 percent of the tornado-related injuries occurred within valid severe local storm watches. GRA

N92-20325# National Oceanic and Atmospheric Administration, Boulder, CO.
FORECAST SYSTEMS LABORATORY ANNUAL REPORT, 1990
Jul. 1991 51 p
(PB92-113851) Avail: NTIS HC/MF A04 CSCL 04B

The Forecast Systems Lab (FSL) was established in October or 1988 with the mission to transfer advances in science and technology to the nation's operational prediction services. It is one of the 11 labs that make up NOAA's Environmental Research Labs (ERL). The progress and plans for the lab are detailed. Some of the highlights include: Mesoscale and local scale analysis; DARE System; Norman System; Profiler demonstration network; Forecasting exercises; Aviation gridded forecast system; UNIX workstation. The system uses the UNIX operating system, and provides many of the functions found in the DARE system, such

as an advanced user interface and high resolution displays. The system will be used by the Cooperative Program for Meteorology Education and Training (COMET Program) for meteorological education. Author

N92-20326# National Oceanic and Atmospheric Administration, Washington, DC. Office of the Chief Scientist.
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION TECHNICAL EXCHANGE CONFERENCE
1991 117 p Conference held in Columbia, MD, 26-28 Feb. 1990
(PB92-115955) Avail: NTIS HC/MF A06 CSCL 04B

A broad cross section of 57 NOAA participants from NWS, ERL, NESDIS, and NOS was asked to prepare ahead of time, from selected reading material distributed to all, for focused presentations on the results from the first NOAA TE conference, plans for the National Weather Service (NWS) Modernization and Restructuring, and relevant capsule research presentations from ERL and NESDIS Labs. The stated purpose of this conference was to form four working groups which, after hearing the aforementioned presentations, would develop prioritized research agendas and strategies for providing improved NWS/NOAA services during and after the Modernization process. The four working groups were responsible for producing reports on the following four NWS service areas: aviation weather; marine weather, severe weather (3 subgroups: convective storms, winter storms, and severe tropical weather); and hydrometeorological services in the 1990's. Author

N92-20365 North Carolina State Univ., Raleigh.
ROLE OF A CRITICAL LEVEL IN A SHEAR FLOW WITH DIABATIC FORCING Ph.D. Thesis
Hye-Yeong Chun 1991 175 p
Avail: Univ. Microfilms Order No. DA9123348

The response of a two-dimensional, stratified shear flow with a critical level to diabatic cooling, which represents the evaporative cooling of falling precipitation in the subcloud layer, is studied using both a linear analytic theory and a nonlinear numerical model. The ambient wind has either a constant shear in the whole domain or a three-layer structure with a constant shear layer bounded by uniform wind layers. It is found that the wind shear can modify the condition at which the upstream propagation of the density current is just opposed by the ambient wind. When the wind shear and the basic wind are opposite sign in the cooling region, a relatively weak ambient wind is enough to prevent the upstream propagation of the density current. Results from the nonlinear numerical simulations indicate that the response of the atmosphere to a steady cooling in a shear flow may be categorized as either a stationary cold pool or a density current, depending upon the strength of the effective cooling. The dynamic and thermodynamic characteristics of squall line are studied using a numerical model with moist convective processes resolved explicitly. Results indicated that the mesoscale circulation is strongly dependent on the ambient wind for a given environmental sounding.
Dissert. Abstr.

N92-20393# Beleidscommissie Remote Sensing, Delft (Netherlands).
PRODUCT DEVELOPMENT PLAN AGROMETEOROLOGY AND CROP FORECASTING Final Report
A. Rosema, N. Roskam, A. A. vandeGriend, and M. Menenti (Winand Staring Centre, Wageningen, Netherlands) Jul. 1991 63 p Prepared in cooperation with NLR, Amsterdam, Netherlands
(BCRS Proj. CO-1.18)
(BCRS-90-24; ETN-92-90980) Avail: NTIS HC/MF A04

The drafting of a remote sensing product development plan on the field of yield forecasting and agrometeorology was addressed. The exploitation of meteorological satellite data for this kind of Earth observation purpose is studied with focus on the African continent. Monitoring techniques under consideration are described and aspects of a market reconnaissance study undertaken are discussed. The product package is described and the actual product development plan is presented. ESA

N92-20411*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
ATMOSPHERIC ENVIRONMENT FOR SPACE SHUTTLE ATLANTIS (STS-39) LAUNCH
G. L. Jasper and G. W. Batts (New Technology, Inc., Huntsville, AL.) Jan. 1992 45 p
(NASA-TM-103574; NAS 1.15:103574) Avail: NTIS HC/MF A03 CSCL 04B

A summary is presented of selected atmospheric conditions observed near space shuttle Atlantis STS-39 launch time on 28 April 1991, at Kennedy Space Center, FL. Values of ambient pressure, temperature, moisture, ground winds, visual observations (cloud), and winds aloft are included. The sequence of prelaunch Jimsphere measured vertical wind profiles is given. The final atmospheric tape, which consists of wind and thermodynamic parameters versus altitude, for STS-39 vehicle ascent was constructed. The STS-39 ascent atmospheric data tape was constructed by NASA-Marshall to provide an internally consistent data set for use in postflight performance assessments and represents the best estimate of the launch environment to the 400,000 ft altitude that was traversed by the STS-39 vehicle.
Author

N92-20437# Air Force Environmental Technical Applications Center, Asheville, NC.
SURFACE OBSERVATION CLIMATIC SUMMARIES FOR GEORGE AFB, CA Report, Jan. 1942 - May 1990
Dec. 1990 375 p
(AD-A235105; USAFETAC/DS-90/235) Avail: NTIS HC/MF A16 CSCL 04/2

Presented is a summary of the hourly climatic observations made at George Air Force Base in California between June 1980 and May 1990. Also presented are summaries of daily observations from: January 1942 to February 1946, April 1948 to October 1948, and September 1950 to May 1990. The summary is arranged into nine sections: (1) introduction, term definition, and abbreviation; (2) atmospheric phenomena summaries; (3) precipitation, snowfall, and snow depth; (4) surface wind; (5) ceiling, visibility, and sky cover; (6) temperature and relative humidity; (7) pressure; (8) crosswind summaries; and (9) degree day summaries. H.A.

N92-20495 European Organization for the Exploitation of Meteorological Satellites, Darmstadt (Germany, F.R.).
[EUMETSAT ACTIVITIES REPORT] Annual Report, 1988
1989 55 p In ENGLISH and FRENCH Original contains color illustrations
(EUM-AR-02; ISSN-1013-3410; ETN-92-91071) Copyright
Avail: Fachinformationszentrum Karlsruhe, 7514 Eggenstein-Leopoldshafen 2, Fed. Republic of Germany

The 1988 European Meteorological Satellite Group (EUMETSAT) annual report is presented. A summary of the year's activities covering the launch of Meteosat 3, the other Meteosat satellites, the data collection system, international cooperation and scientific meetings, is given. Details of the performance of missions involved with the following are given: imaging the Earth in three spectral bands from Meteosat; disseminating digital imagery to Primary Data User Stations (PDUS); disseminating analog imagery and other data to Secondary Data User Stations (SDUS); relaying of images from the U.S. GOES-E geostationary satellite, to both PDUS and SDUS; deriving and distributing meteorological products from the Meteosat image data; collecting and distributing observational data from remote sites, through the Meteosat Data Collection System (DCS); and operating the data relay system for rapid distribution of special DCS data. Other activities described are involved with monitoring the development, by ESA and Industry, of the new satellites of the Meteosat Operational Programme (MOP satellites) to be launched from 1988; developing, with ESA, the Meteorological Data Distribution (MDD) system for use with the new MOP satellites; preparing for new programs in line with the outline EUMETSAT long term plan; preparing to take over overall

responsibility for support of U.S. polar orbiting satellites through equipment installed in Lannion, France and operated by the Meteorologie Nationale; and preparing principles for a distribution and charging policy concerning Meteosat data, products and services. Details of EUMETSAT's objectives, establishment, structure, finance, and publications are also given. ESA

N92-20496 European Organization for the Exploitation of Meteorological Satellites, Darmstadt (Germany, F.R.).
EUMETSAT MISSIONS AND SERVICES
1989 44 p In ENGLISH, FRENCH, and GERMAN Original contains color illustrations
(EUM-BR-02; ETN-92-91072) Copyright Avail: EUMETSAT, Am Elfengrund 45, D-6100 Darmstadt-Eberstadt, Fed. Republic of Germany

A reference to the main missions and services provided by EUMETSAT is presented in the form of a series of fact sheets which act as a source of basic information on each topic and which reference further information. Topics covered include: EUMETSAT: the European organization for meteorological satellites; global meteorological satellite systems; geostationary meteorological satellites; the preoperational Meteosat satellites: Meteosat 1, 2, 3; the operational Meteosat satellites: Meteosat 4, 5, 6; the Meteosat system; Meteosat Atlantic; the Meteosat imaging system; Meteosat digital image dissemination; Meteosat analog image dissemination; Meteosat image relay service; Meteosat's Data Collection System (DCS); the Meteosat DCP Retransmission System (DCPRS); Meteorological Data Distribution (MDD); combined use of standard EUMETSAT facilities (MOSAIC); centrally produced Meteosat meteorological data; NOAA polar satellite support; and Meteosat archive and data services. A list of all current EUMETSAT publications is included. ESA

N92-20576 European Organization for the Exploitation of Meteorological Satellites, Darmstadt (Germany, F.R.).
[EUMETSAT ACTIVITIES REPORT] Annual Report, 19 Jun. 1986 - 31 Dec. 1987
1988 52 p In ENGLISH and FRENCH
(EUM-AR-01; ISSN-1013-3410; ETN-92-91070) Copyright Avail: Fachinformationszentrum Karlsruhe, 7514 Eggenstein-Leopoldshafen 2, Fed. Republic of Germany

The first annual report on EUMETSAT activities covering the period from 19 Jun. 1986 to 31 Dec. 1987 is presented. A summary of the years activities is given which includes the creation of the organization, work done by Meteosat 2 and the data collection system, meteorological product extraction, and refurbishment of the ground segment. Details of the performance of missions involved with the following are given: imaging the Earth in three bands spectral from Meteosat; disseminating digital imagery to primary Data User Stations (DUS); disseminating analog imagery and other data to Secondary Data User Stations (SDUS); relaying of images from the U.S. GOES-E geosationary satellite, to both PDUS and SDUS; deriving and distributing meteorological products from the Meteosat image data; collecting and distributing observational data from remote sites through the Meteosat Data Collection System (DCS); operating the data relay system for rapid distribution of special DCS data. ESA

N92-20655# National Weather Service, Salt Lake City, UT.
WEATHER EXTREMES (2ND REVISION, OCTOBER 1991)
R. J. Schmidli Oct. 1991 26 p
(PB92-115062) Avail: NTIS HC/MF A03 CSCL 04B

This text was created to provide National Weather Service personnel with a ready reference of information that may be useful when preparing weather stories and radio scripts, when talking to mass-media reporters, and when answering questions from the general public. The eighth revision differs from the seventh revised tabulation in that a number of new extremes were updated and previous errors were corrected. The memorandum is organized into fifteen categories covering the elements of temperature, precipitation, snowfall, atmospheric pressure, and wind. The fourteen western cities, thirteen western states, United States, North America, and world are each listed in the various categories. GRA

N92-20656# National Center for Atmospheric Research, Boulder, CO. Atmospheric Technology Div.
PREPROCESSING OF AIRBORNE PYRANOMETER DATA
L. Bannehr and V. Glover Sep. 1991 45 p
(PB92-119627; NCAR/TN-364+STR) Avail: NTIS HC/MF A03 CSCL 04B

On the three research aircraft of the National Center for Atmospheric Research (NCAR), Eppley pyranometers are employed to measure the up- and down-welling short wavelength radiation fluxes in the atmosphere. The quality of the data used to investigate the radiation budget and extinction of solar irradiance depends strongly on the calibration and correction applied to the radiation data, accounting for the following: (1) cosine response of the instruments; (2) ambient temperature effects; (3) leveling of the radiometers; and (4) aircraft maneuvers during the observations. The report makes suggestions about how the quality of the radiation data can be enhanced by a more accurate calibration procedure and correction scheme. By considering the recommendations, data from the upward facing pyranometer can be improved by about 20 percent under clear sky conditions. GRA

N92-20670*# Mesoscale Environmental Simulations and Operations, Inc., Troy, NY.
MODEL STUDIES ON THE ROLE OF MOIST CONVECTION AS A MECHANISM FOR INTERACTION BETWEEN THE MESOSCALES Final Report
Kenneth T. Waight, III, J. Aaron Song, John W. Zack, and Pamela E. Price 22 Jul. 1991 75 p Prepared in cooperation with Universities Space Research Association, Huntsville, AL
(Contract NAS8-37141)
(NASA-CR-184284; NAS 1.26:184284) Avail: NTIS HC/MF A04 CSCL 04B

A three year research effort is described which had as its goal the development of techniques to improve the numerical prediction of cumulus convection on the meso-beta and meso-gamma scales. Two MESO models are used, the MASS (mesoscale) and TASS (cloud scale) models. The primary meteorological situation studied is the 28-29 Jun. 1986 Cooperative Huntsville Meteorological Experiment (COHMEX) study area on a day with relatively weak large scale forcing. The problem of determining where and when convection should be initiated is considered to be a major problem of current approaches. Assimilation of moisture data from satellite, radar, and surface data is shown to significantly improve mesoscale simulations. The TASS model is shown to reproduce some observed mesoscale features when initialized with 3-D observational data. Convection evolution studies center on comparison of the Kuo and Fritsch-Chappell cumulus parameterization schemes to each other, and to cloud model results. The Fritsch-Chappell scheme is found to be superior at about 30 km resolution, while the Kuo scheme does surprisingly well in simulating convection down to 10 km in cases where convergence features are well-resolved by the model grid. Results from MASS-TASS interaction experiments are presented and discussed. A discussion of the future of convective simulation is given, with the conclusion that significant progress is possible on several fronts in the next few years. Author

N92-20686# Washington Univ., Seattle. Dept. of Atmospheric Sciences.
A NUMERICAL STUDY OF THUNDERSTORM ELECTRIFICATION: INITIAL ELECTRIFICATION AND THUNDERSTORM CLIMATOLOGY Annual Progress Report, 11 Dec. 1990 - 15 Nov. 1991
Marcia Baker and Robert Solomon 15 Nov. 1991 5 p
(Grant AF-AFOSR-0012-91)
(AD-A244638; AFOSR-91-1027TR) Avail: NTIS HC/MF A01 CSCL 04/2

Our purpose is to identify those atmospheric conditions that lead to thunderstorm electrification. We have collected aircraft and radar measurements of atmospheric parameters made during

several recent intensive field studies, and we are modifying our thunderstorm model to make it more realistic. The radar measurements will be used as inputs to the model and we will attempt in-cloud microphysical, dynamical, and electrical behavior in a range of atmospheric environments. As our simulations evolve, we will examine the relationships between atmospheric sounding parameters and subsequent electric field development, and we will classify soundings in terms of parameters relevant for lightning production. GRA

N92-20712# Naval Postgraduate School, Monterey, CA.
NUMERICAL STUDIES OF THE BETA-EFFECT IN TROPICAL CYCLONE MOTION USING A SEMI-LAGRANGIAN MODEL M.S. Thesis
TeriAnn Lentz Dec. 1991 50 p
(AD-A244915) Avail: NTIS HC/MF A03 CSCL 04/2

It has been found that the beta effect can have an important effect on tropical cyclones. To conduct an experimental study of tropical cyclone movement on a beta plane a numerical model was developed. This model is based on the barotropic vorticity equation and used a semi-Lagrangian technique for the advective terms. The basic model is studied for accuracy and efficiency. It is seen that the accuracy of the semi-Lagrangian scheme is very good at moderate grid intervals, 20 km to 40 km, producing a much smoother vorticity field than that produced by the finite difference model. The efficiency of the semi-Lagrangian scheme as the time interval was increased was not fully achieved due to the shear effect in this regional model. When the beta effect was added, the model predicted vortex tracks and beta gyres compared well with those obtained from the finite difference model with a 20 km grid size. However, the semi-Lagrangian forecast with a grid size of 10 km gave somewhat different track, which could not be explained. GRA

N92-20829# Naval Postgraduate School, Monterey, CA.
NOAA'S WEATHER SATELLITES: ECONOMICALLY BENEFICIAL PATHFINDERS M.S. Thesis
Andrew H. Wilson 25 Sep. 1991 76 p
(AD-A245276) Avail: NTIS HC/MF A05 CSCL 04/2

The National Oceanic and Atmospheric Administration's (NOAA) meteorological satellites have made many important contributions to society since their first introduction over 30 years ago. These polar-orbiting and geostationary satellite systems provide weather information as well as other benefits to both the public and private sector. This thesis examines a number of these economically benefitted areas and quantifies these contributions when possible. Additionally, the concept of weather satellite provided data as a public or a private good is analyzed. The growing private sector application of satellite derived data, or so called value-added service, is surveyed. A few key examples of this field are identified, and the impacts of past, current, and future governmental data dissemination policies are discussed. In conclusion, the role NOAA's environmental satellites will play in the planned global observation of the earth is discussed. By studying these satellite systems in this way, their worldwide benefits to society can be ascertained, both in terms of current economic benefits as well as their important role as a test case for the future of earth remote sensing. GRA

N92-20846 Royal Netherlands Meteorological Inst., De Bilt. Afdel. Fysische Meteorologie.
ESTIMATION OF DIRECT AND DIFFUSE RADIATION AND OF SUNSHINE DURATION FROM 10-MINUTE VALUES OF GLOBAL RADIATION
W. H. Slob and W. A. A. Monna 1991 40 p In DUTCH; ENGLISH summary
(KNMI-TR-136; ISBN-90-369-2001-9; ISSN-0169-1708; ETN-92-91037) Copyright Avail: Royal Netherlands Meteorological Inst., P.O. Box 201, 3730 AE De Bilt, Wilhelminalaan 10, Netherlands

A procedure to estimate the diffuse and direct components of global radiation from 10 minute mean and extreme values measured by a pyranometer is presented. The advantage of this procedure is that no special instruments are required. Relations between the parameters amount and type of clouds, Sun elevation angle and link turbidity are given, which can be used to estimate the direct and diffuse components. Criteria were developed to discriminate between the various cloud situations. In most situations a correct estimation of the direct and diffuse components can be given with an accuracy of about 10 pct. The sunshine duration results compare well with those derived from pyrothermometer measurements of the direct radiation, and have an accuracy of about plus or minus 0.6 hours for daily sums. ESA

N92-20864 Royal Netherlands Meteorological Inst., De Bilt. Fysische Meteorologie.
RELATIVE TRAJECTORIES IN AND AROUND A DEPRESSION [RELATIEVE TRAJECTORIEN IN EN ROND EEN DEPRESSIE]
Jeroen P. A. J. vanBeeck 1991 74 p In DUTCH; ENGLISH summary
(KNMI-TR-135; ISSN-0169-1708; ETN-92-91036) Copyright Avail: Royal Netherlands Meteorological Inst., P.O. Box 201, 3730 AE De Bilt, Wilhelminalaan 10, Netherlands

Trace gas trajectories in the troposphere were calculated in order to check the usefulness of the wind fields, produced by the forecast model of the ECMWF (European Center for Medium range Weather Forecasts). The trajectories in and around a standard moving extratropical cyclone were calculated using an improved version of the TRACE model. The most important conclusion is that for the selected cyclone the air, remaining in the stream regimes predicted by the analytical model, does not contribute to the exchange between troposphere and stratosphere. The exchange takes place by transition from one stream regime to another. The picture of the relative trajectories in the selected cyclone is not so beautifully symmetric as the picture from the analytical model. ESA

N92-20609 Centre National d'Etudes Spatiales, Toulouse (France).
RESEARCH AND DEVELOPMENT OF THE UARS-WINDII SCIENTIFIC PROJECT [LA REALISATION DU PROJET SCIENTIFIQUE UARS-WINDII]
Francoise Girod *In its* The Management of Large Software Projects in the Space Industry Jun. 1991 p 253-262 In FRENCH Previously announced in IAA as A91-47771 (For primary document see N92-20589 11-61)
Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

48 OCEANOGRAPHY

Includes biological, dynamic, and physical oceanography; and marine resources.

For related information see also *43 Earth Resources and Remote Sensing.*

N92-20257# National Oceanic and Atmospheric Administration, Boulder, CO. Wave Propagation Lab.
INTERNAL WAVE CONTRIBUTIONS TO OCEAN REMOTE SENSING BY ACOUSTIC SCINTILLATION ANALYSIS
R. J. Lataitis Sep. 1991 59 p
(PB92-118819; NOAA-TM-ERL-WPL-209) Avail: NTIS HC/MF A04 CSCL 08C

Previous theoretical developments describing the use of acoustic scintillation analysis for the measurement of currents and microscale variability along horizontal acoustic paths required that Taylor's frozen flow hypothesis be satisfied. Refractive irregularities were assumed to be passive tracers that were simply advected by the mean flow across the propagation path. This requirement restricted the application of the scintillation technique to well mixed turbulent flows. Two propagation geometries were considered in detail. The most simple comprised a single transmitter and two spaced receivers. The configuration allowed the retrieval of the path integrated transverse current and microscale variability as

characterized by the refractive index structure. The earlier theories are extended to include internal wave contributions to the scintillation signal. Author

N92-20262# National Oceanic and Atmospheric Administration, Seattle, WA. Pacific Marine Environmental Lab.
EQUATORIAL WIND, CURRENT AND TEMPERATURE DATA: 108 DEG W TO 140 DEG W; APRIL 1983 TO OCTOBER 1987
H. P. Freitag, M. J. McPhaden, C. S. Coho, and A. J. Shepherd Aug. 1991 116 p
(PB92-119817; NOAA-DR-ERL-PMEL-35; CONTRIB-1279) Avail: NTIS HC/MF A06 CSCL 08C

Since January of 1979 surface moored arrays have been measuring surface winds, air temperatures, sea surface temperatures, and upper ocean currents near the equator, between 85 deg W and 140 deg W, as part of NOAA's Equatorial Pacific Ocean Climate Studies (EPOCS) Program. The purpose of these arrays is to provide information on the circulation of the equatorial Pacific and its relation to short term climate variability associated with the El Nino/Southern Oscillation phenomenon. The report covers wind, current, and temperature measurements made between 108 deg W and 140 deg W from April of 1983 through October of 1987. GRA

N92-20685# Coastal Engineering Research Center, Vicksburg, MS.
WAVE INFORMATION STUDIES OF US COASTLINES: HINDCAST WAVE INFORMATION FOR THE GREAT LAKES: LAKE ERIE Final Report
David B. Driver, Robin D. Reinhard, and Jon M. Hubertz Oct. 1991 403 p
(AD-A244618; CERC-WIS-22) Avail: NTIS HC/MF A18 CSCL 08/8

Thirty-two years of hindcast wind and wave information is summarized for 53 locations along the shoreline of Lake Erie in four data products: percent occurrence tables, wave rose diagrams, mean and largest wave height and 32-year statistics tables, and return period tables. The procedures used to produce this information are discussed, and examples of verification against measurements are shown. GRA

51 LIFE SCIENCES (GENERAL)

N92-20215# Office of Technology Assessment, Washington, DC.
BIOTECHNOLOGY IN A GLOBAL ECONOMY
Oct. 1991 293 p
(PB92-115823; OTA-BA-494; ISBN-0-16-035541-9) Avail: NTIS HC/MF A13; also available SOD HC $13.00 as 052-003-01258-8 CSCL 06C

The impact is examined of biotechnology in several industries, including pharmaceuticals, chemicals, agriculture, and hazardous waste clean up. The efforts of 16 Nations to develop commercial uses of biotechnology is also examined along with the actions, both direct and indirect, taken by various governments that influence innovation in biotechnology. Author

N92-20422*# Georgia State Univ., Atlanta.
HUMAN BEHAVIOR AND HUMAN PERFORMANCE: PSYCHOMOTOR DEMANDS Semiannual Status Report, Sep. 1991 - Feb. 1992
Feb. 1992 9 p
(Grant NAG2-438)
(NASA-CR-190112; NAS 1.26:190112) Avail: NTIS HC/MF A02 CSCL 06A

The results of several experiments are presented in abstract form. These studies are critical for the interpretation and acceptance of flight based science to be conducted by the Behavior and Performance project. Some representative titles are as follow: External audio for IBM/PC compatible computers; A comparative assessment of psychomotor performance (target prediction by humans and macaques); Response path (a dependent measure for computer maze solving and other tasks); Behavioral asymmetries of psychomotor performance in Rhesus monkey (a dissociation between hand preference and skill); Testing primates with joystick based automated apparatus; and Environmental enrichment and performance assessment for ground or flight based research with primates; Author

N92-20453# Virginia Commonwealth Univ., Richmond. Dept. of Physiology.
EFFECTS OF 27 MHz RADIATION ON SOMATIC AND GERM CELLS Report, 27 Sep. 1985 - 29 Sep. 1990
S. F. Cleary 18 Jan. 1991 11 p
(Grant NIOSH-R01-OH-02148)
(PB92-124007) Avail: NTIS HC/MF A03 CSCL 06C

A study was made of the dose dependence of effects of 27 and 2450 MHz continuous wave (CW) and pulse modulated (PM) radiation exposure of normal resting peripheral human lymphocytes, human glioma (LN71), HeLa, and Chinese-hamster-ovary (CHO) cells. Direct radiation effects on mouse germ cells were also studied. Effects of high frequency electromagnetic radiation (EMR) on lymphocyte and glioma mitogenesis and the CHO cell cycle in-vitro provide evidence of direct dose or dose rate dependent alteration of a highly physiologically significant cellular endpoint. Although in-vitro data cannot be extrapolated directly to in-vivo responses, the experimental conditions of these in-vitro studies suggest that qualitatively similar effects may be induced by in-vivo exposure to electromagnetic fields of these frequencies. It is concluded that physiologically significant cellular alterations are induced by 27 and 2450 MHz CW and PM radiation exposure under conditions that do not involve heating. It is suggested that the adequacy of radio frequency occupational exposure guidelines that suggest the health effects are attributable to radiation induced tissue heating must be questioned. Author

N92-20704# Kansas Univ., Lawrence. Center for Biomedical Research.
GLUTAMATE/NMDA RECEPTOR ION-CHANNEL PURIFICATION, MOLECULAR STUDIES, AND RECONSTITUTION INTO STABLE MATRICES Final Report, 15 Mar. 1988 - 1 Jul. 1991
Elias K. Michaelis 29 Aug. 1991 6 p
(Contract DAAL03-88-K-0017)
(AD-A244727; ARO-25702.1-LS) Avail: NTIS HC/MF A02 CSCL 06/5

This is the final report of a project that had as its primary focus the isolation of the NMDA receptor protein complex and the reconstitution of these proteins for the development of biosensors. The progress made in all phases of this work has met the goals selected for the research. (1) Two proteins of the receptor were fully purified and characterized. (2) The intact complex was purified and biochemically characterized. (3) One of the protein DNA's was cloned and sequenced. (4) The complex was reconstituted into liposomes and planar lipid bilayers. (5) A prototype sensor based on this receptor complex was developed. (6) Cell model systems for the study of the receptor were developed. GRA

N92-20813# Pathology Associates, Inc., Frederick, MD.
ANIMAL MODELS OF IONIZING RADIATION DAMAGE Technical Report, 18 May 1988 - 18 May 1991
Lynda L. Pippin 1 Jan. 1992 316 p
(Contract DNA001-88-C-0120; DA Proj. R99-QAXE)
(AD-A245268; DNA-TR-91-111) Avail: NTIS HC/MF A14 CSCL 06/7

This report is a survey of the English language literature of radiation biology between 1947 and 1987, for the purpose of compiling a literature base on the effects of radiation on animals, which have yielded results that can expand our knowledge about similar radiation effects on human beings. Articles were sought that reported exposure of adult mammals to external sources of ionizing radiation, having endpoints that included effects on the

brain, the spinal cord, and behavior, the gastrointestinal, endocrine, and cardiovascular systems, and the hematopoietic and immune systems. Effects of interest were those that occurred within the first 12 months after exposure. The survey does not include articles reporting chronic or long term delayed effects of radiation unless they provided insight into mechanisms of morphological and/or functional derangement. Information presented in the report is divided into subtopics (i.e., Brain-Morphological Changes). The brief introduction to each subtopic is followed by a condensed description of representative reports and a short summary of conclusions based on those reports. The articles reviewed are appended as a Bibliography, arranged alphabetically within subtopics. GRA

N92-21044# California Univ., Berkeley. Dept. of Plant Biology.
PHYTOCHROME FROM GREEN PLANTS: ASSAY, PURIFICATION, AND CHARACTERIZATION
P. H. Quail 10 Jun. 1991 17 p Prepared in cooperation with Agricultural Research Service, Albany, CA
(Contract DE-FG03-87ER-13742)
(DE92-003396; DOE/ER-13742/5) Avail: NTIS HC/MF A03

This funding period was directed at developing an in-depth molecular analysis of the low-abundance, 118,000 M(sub r) green-tissue phytochrome that had at that time been relatively recently identified as being distinct from the better characterized 124,000 M(sub r) phytochrome abundant in etiolated tissue. The specific objectives as stated in the original proposal were: (1) to generate monoclonal antibodies specific to the 118,000 M(sub r) green-tissue phytochrome; (2) to develop additional and improved procedures to permit progress toward the ultimate goal of purifying green-tissue phytochrome to homogeneity; (3) to initiate an alternative approach to determining the structural properties of green-tissue phytochrome by isolating and sequencing cDNA clones representing the 118,000 M(sub r) green-tissue polypeptide in Avena (this approach is based on and will test hypothesis that the 118,000 M(sub r) polypeptide is encoded by a gene(s) distinct from those encoding etiolated-tissue 124,000 M(sub r) phytochrome); (4) to utilize any such 118,000 M(sub r) phytochrome specific cDNA clones as hybridization probes to begin to investigate the structure, organization, and regulation of the corresponding gene(s) in Avena; and (5) to begin to investigate the possible presence in other higher plant and algal species of sequences homologous to the 118,000 M(sub r) Avena polypeptide using the Avena clones at hybridization probes. Most of these objectives have been accomplished, at least in principle, although the major breakthrough establishing that phytochrome is encoded by a multigene family came from the use of Arabidopsis rather than Avena. Similarly, much of the characterization subsequent to this discovery has been performed in Arabidopsis and rise as model dicot and monocot systems, respectively, rather than Avena. DOE

52 AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

N92-20276*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
MUSCLE ULTRASTRUCTURAL CHANGES FROM EXHAUSTIVE EXERCISE PERFORMED AFTER PROLONGED RESTRICTED ACTIVITY AND RETRAINING IN DOGS
K. Nazar, J. E. Greenleaf, D. Philpott, E. Pohoska, K. Olszewska, and H. Kaciuba-Uscilko (Polish Academy of Sciences, Warsaw.) Nov. 1991 25 p
(NASA-TM-103904; A-92018; NAS 1.15:103904) Avail: NTIS HC/MF A03 CSCL 06P

The effect of exhaustive treadmill exercise on ultrastructural changes in the quadriceps femoris muscle was studied in 7 normal, healthy dogs, before and after restricted activity (RA), and following a subsequent 2 month treadmill exercise retraining period for the 5 mo group. Mean time to exhaustion in the 2 mo group decreased from 177 + or - 22 min before to 90 + or - 32 min after RA. Retraining increased tolerance to 219 + or - 73 min; 24 pct. above the before RA and 143 pct. above the after RA time. After RA exhaustion time in the 5 mo group was 25 and 45 min. Before RA, pre-exercise muscle structure was normal and post exercise there was only slight swelling of mitochondria. After RA, pre-exercise, numerous glycogen granules and lipid droplets appeared in the muscle fibers, mitochondria were smaller, and sarcoplasmic reticulum channels widened; post exercise these changes were accentuated and some areas were devoid of glycogen, and there was fiber degradation. After 5 mo RA pre-exercise there were more pronounced changes; mitochondria were very small and dense, there were many lipid droplets, myofibrils were often separated, and the fibers appeared edematous and degenerating; post exercise the sarcoplasmic reticulum was swollen, no glycogen was present, and there was marked swelling and deformation of mitochondria. After retraining, both pre-exercise and post exercise there was still evidence of fiber degeneration. Thus, susceptibility of active skeletal muscle structures and subcellular elements, e.g., mitochondria, to the action of damaging factors occurring during exhaustive exercise is enhanced considerably by prolonged disuse. Author

N92-20440# Defence and Civil Inst. of Environmental Medicine, Downsview (Ontario).
BLOOD LACTATE RESPONSE TO THE CF EXPRES STEP TEST Final Report
D. G. Bell and I. Jacobs 18 Jun. 1991 19 p
(DCIEM-91-44; CTN-92-60450) Avail: NTIS HC/MF A03

This is the final report on the tasking to look at the blood lactate (LA) response to the Canadian Aerobic Fitness Test. The purposes of the study were to determine if LA could be used to predict maximal aerobic power from the EXPRES step-test procedures and to compare the prediction with the current procedures which employ submaximal heart rate (HR). Male and female Canadian Forces personnel between the ages of 18 and 53 years participated in the study. The LA concentration after each stage of the step test was measured in all subjects by sampling blood from the fingertip. A sub-sample of the population had their maximal aerobic power measured directly during a maximal treadmill run. LA and HR from stage 5 of the step-test were correlated with the treadmill determined maximal aerobic power. The results showed increasing stages of the step test were associated with increasing LA. Correlations between LA and maximal aerobic power were -0.71 and -0.72 for the males and females, respectively, and were higher than the correlations between HR and the maximal aerobic power which were -0.36 and -0.65 respectively. Age appears to be the main difference in LA response between males and females. Author (CISTI)

N92-20668*# MCAT Inst., San Jose, CA.
INCOMPRESSIBLE VISCOUS FLOW COMPUTATIONS FOR THE PUMP COMPONENTS AND THE ARTIFICIAL HEART Final Report
Cetin Kiris Mar. 1992 13 p Original contains color illustrations
(Contract NCC2-500)
(NASA-CR-190076; NAS 1.26:190076; MCAT-92-003) Avail: NTIS HC/MF A03; 1 functional color page CSCL 06C

A finite difference, three dimensional incompressible Navier-Stokes formulation to calculate the flow through turbopump components is utilized. The solution method is based on the pseudo compressibility approach and uses an implicit upwind differencing scheme together with the Gauss-Seidel line relaxation method. Both steady and unsteady flow calculations can be performed using the current algorithm. Here, equations are solved in steadily rotating reference frames by using the steady state formulation in order to simulate the flow through a turbopump inducer. Eddy viscosity is computed by using an algebraic mixing-length turbulence model. Numerical results are compared with experimental measurements and a good agreement is found between the two. Author

N92-20709# Colorado Univ., Boulder. Cardiovascular Pulmonary Research Lab.
HUMAN ADAPTATION TO THE TIBETAN PLATEAU Final Report, 7 Aug. 1987 - 30 Jun. 1991
Lorna G. Moore 12 Aug. 1991 79 p
(Contract DAMD17-87-C-7202; DA Proj. 3M1-62787-A-879)
(AD-A244872) Avail: NTIS HC/MF A05 CSCL 06/5

Humans have lived at high altitude for longer periods of time on the Tibetan Plateau than elsewhere in the world, thus providing the opportunity to investigate the physiologic effects of long-term (years to generation) duration of high altitude exposure. This has military importance because persons are stationed at high altitudes for extended periods of time and experience marked decrements in performance and health. Knowledge as to the physiologic traits required for successful high-altitude adjustment is important for the selection of personnel resistant to the ill effects of high altitude and for the treatment of afflicted individuals. The results of this research supported the underlying hypothesis that Tibetans are better-adapted to high altitude than acclimatized newcomers in Tibet or than persons elsewhere in the world as judged from literature reports. The Tibetans' superiority was evidenced by greater maximal oxygen uptake, higher work capacity, increased greater vital capacity and lung volume, decreased alveolar-arterial oxygen diffusion gradient, absence of hypoxic pulmonary vasoconstriction, increased cardiac output and increased tissue oxygen utilization. In addition, Tibetans are resistant to the development of Chronic Mountain Sickness. Compared to healthy controls, persons with Chronic Mountain Sickness breathe less and have lower arterial oxygen saturations than healthy persons, due to the absence of hypoxic ventilatory sensitivity and greater hypoxic ventilatory depression, and likely suffer from decrements in nocturnal brain oxygen delivery. GRA

N92-20987# Pacific Northwest Lab., Richland, WA.
INTERACTION OF EXTREMELY-LOW-FREQUENCY ELECTROMAGNETIC FIELDS WITH LIVING SYSTEMS
T. S. Tenforde Nov. 1991 6 p Presented at the International Conference on Advances in Power Systems Control, Operation and Management, Hong Kong (China), 5-8 Nov. 1991
(Contract DE-AC06-76RL-01830)
(DE92-006478; PNL-SA-19554; CONF-9111177-1) Avail: NTIS HC/MF A02

The sources and physical properties of extremely-low-frequency (ELF) electromagnetic fields are described. Biological effects and mechanisms through which ELF fields interact with humans and other organisms are discussed, including several aspects of this subject that are presently under active laboratory investigation. Studies on the potential health effects of ELF fields present in the home and workplace are also summarized, including a critical evaluation of evidence for a possible linkage between exposure to ELF fields and cancer risk. DOE

N92-21008# Food and Drug Administration, Rockville, MD. Office of Science and Technology.
PREVIEW OF MAGNETOENCEPHALOGRAPHY (MEG)
May 1991 57 p
(PB92-111632) Avail: NTIS HC/MF A04 CSCL 06P

The Division of Life Sciences within the Office of Science and Technology is responsible for the evaluation of biological information relevant to medical devices and radiological health. As part of the medical device effort, the Health Sciences Branch of the Division of Life Sciences has undertaken a general review of magnetoencephalography (MEG). MEG is a developing technology, based upon superconducting quantum interference devices (SQUIDs), which attempts to record and then analyze the magnetic fields generated by neural activity within the brain. MEG is a noninvasive technique like the traditional electro-encephalography (EEG), but potentially offers an increased precision in the diagnostic analysis of brain function. The purpose of the document is to review the history, research, and current status of MEG as an emerging technology for the noninvasive analysis of normal and abnormal brain function in humans. GRA

N92-21009# Office of Technology Assessment, Washington, DC.
BIOLOGICAL RHYTHMS: IMPLICATIONS FOR THE WORKER. NEW DEVELOPMENTS IN NEUROSCIENCE
Sep. 1991 259 p
(PB92-117589; OTA-BA-463; ISBN-0-16-035497-8) Avail: NTIS HC/MF A12; also available SOD HC $11.00 as 052-003-01254-5 CSCL 06P

An assessment of new developments in neuroscience is conducted. The report discusses biological rhythms: what they are, how they are controlled by the brain, and the role they play in regulating physiological and cognitive functions. The major focus of the report is the examination of the effects of nonstandard work hours on biological rhythms and how these effects can interact with other factors to affect the health, performance, and safety of workers. In addition, the report describes the Federal regulatory framework related to work hours and the current status of biological rhythm and shift work research. The report presents a range of options for congressional action related to the amount of research being conducted on these topics, the collection of relevant workplace statistical data, and the congressional role in ensuring the well-being of individuals engaged in nonstandard hours of work. GRA

N92-21021# School of Aerospace Medicine, Brooks AFB, TX.
FIELD STUDY EVALUATION OF AN EXPERIMENTAL PHYSICAL FITNESS PROGRAM FOR USAF FIREFIGHTERS Final Report, Jun. 1985 - Sep. 1986
L. G. Myhre, W. Grimm, G. R. Van Kirk, R. Tattersfield, and E. T. Sherrill May 1991 30 p
(AD-A244498; AFESC/ESL-TR-90-22) Avail: NTIS HC/MF A03 CSCL 05/9

Under emergency conditions, firefighting demands extraordinary levels of physical effort in performing tasks under some of the most life threatening conditions. Success in performing these tasks depends on the firefighters physical fitness, particularly his/her cardiovascular endurance. Studies have shown that firefighters, both in the civilian and military sectors, are generally less fit than their age-related sedentary American counterparts. This report describes a field study to evaluate the safety and effectiveness of an experimental physical conditioning program that could be prescribed on an individual basis. Special emphasis was placed on a conservative program for older, less fit firefighters who would be most susceptible to exercise-related injury. GRA

53 BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

N92-20694# Mei Associates, Inc., Lexington, MA.
DESIGNING AN ADVANCED INSTRUCTIONAL DESIGN ADVISOR: INCORPORATING VISUAL MATERIALS AND OTHER RESEARCH ISSUES, VOLUME 4 Interim Report, Jul. 1989 - Nov. 1991
Alinda Friedman, Martha C. Polson, and J. M. Spector Dec. 1991 65 p
(Contract F33615-88-C-0003)
(AD-A245107; AL-TP-1991-0017-Vol-4) Avail: NTIS HC/MF A04 CSCL 05/6

The Advanced Instructional Design Advisor (AIDA) is an R and D project being conducted by the Armstrong Laboratory Human Resources Directorate and is aimed at producing automated instructional design guidance for developers of computer-based instructional materials. The process of producing effective computer-based instructional materials is complex and time-consuming. Few experts exist to insure the effectiveness of the process. The content of this paper addresses research issues that pertain to the effective use of visual materials as well as other research issues that arise when attempts are made to automate instructional design. GRA

N92-20713# Medical Research Council, Cambridge (England). Applied Pschology Unit.
THE CENTRAL EXECUTIVE COMPONENT OF WORKING MEMORY Annual Report, 1 Sep. 1990 - 31 Aug. 1991
A. Baddeley, J. Duncan, and H. Emslie 31 Oct. 1991 44 p
(Grant AF-AFOSR-0343-90)
(AD-A244916; AFOSR-91-1006TR) Avail: NTIS HC/MF A03
CSCL 05/8

This research is based upon the hypothesis that three different phenomena - behavioral impairments after frontal lobe damage, 'general intelligence' or Spearman's g, and interference between dissimilar concurrent tasks - all reflect the operation of a central executive (CE) system involved in the organization of many different kinds of behavior. Four sets of experiments are presented. One set shows the frontal lobe damage produces massive impairments in 'intelligence tests' based on current problem-solving ability. A second shows that one characteristic frontal error - mismatch between knowledge of a task's requirement and the resultant behavior - can also be reliably produced in normals, and is closely related to g. The third set of experiments is based on the idea that executive processes lose importance as behavior becomes stereotyped or automatic. If so, generating random sequences should load the CE, whatever their particular content, and the experiments indeed suggest that the demands of random generation are similar for verbal and manual materials. Similarly, the fourth set of experiments suggests that correlations between reaction time and g diminish with practice only if there are no switches in mental set. It is proposed that the CE is a system for detection/selection of goal states in novel behavioral settings. GRA

N92-20895# Smith-Kettlewell Inst. of Visual Sciences, San Francisco, CA.
VISUAL PROCESSING OF OBJECT VELOCITY AND ACCELERATION Final Technical Report, 15 Oct. 1988 - 14 Oct. 1991
Suzanne McKee 13 Dec. 1991 136 p
(Contract FQ8671-90-O-1374)
(AD-A244658; AFOSR-91-1030TR) Avail: NTIS HC/MF A07
CSCL 05/8

Six separate projects have explored how velocity and acceleration are encoded in the human visual system: (1) Welch demonstrated that speed discrimination for coherent plaid patterns formed of two superimposed gratings was limited by the speed of the gratings, not the apparent speed of the plaid itself; (2) Bowne et al. and more recently Grzywacz, applied 'motion-energy' models to the psychophysics of speed discrimination; (3) McKee and Welch compared the relative precision of velocity and size constancy, finding little evidence for velocity constancy in human motion processing; (4) Watamaniuk demonstrated that the visual system integrates diverse speeds (2-8 deg/sec) in a random dot display to obtain a precise estimate of the mean speed; (5) McKee and Watamaniuk found that a single point (the signal) moving in apparent motion along a fixed trajectory was easily detected amidst other similar points in random apparent motion (the noise), even though the spatial and temporal characteristics of the signal and noise points were identical on a frame-by-frame basis; and (6) Bravo and Watamaniuk showed that two sets of randomly distributed dots moving in the same direction, but at two very different speeds, formed two transparent planes; discrimination of small changes in the speed of one set of dots was unaffected by the presence of the other dots. GRA

54 MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

For related information see also *16 Space Transportation.*

N92-20046# Sandia National Labs., Albuquerque, NM.
SOLAR DETOXIFICATION OF WATER CONTAINING CHLORINATED SOLVENTS AND HEAVY METALS VIA TiO2 PHOTOCATALYSIS
M. R. Prairie, J. Pacheco, and L. R. Evans 1991 20 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE91-018396; SAND-91-1285C; CONF-920436-3) Avail: NTIS HC/MF A03

Researchers around the world have demonstrated the effectiveness of titanium dioxide-based photocatalysis for decontaminating water containing hazardous organics and heavy metals. A great advantage of this process is that the organic is completely destroyed, leaving behind only water, carbon dioxide and dilute mineral acids. Also, the process has potential for doing two decontamination jobs at once: oxidizing organics while reducing toxic metals. As part of a program sponsored by the DOE, Sandia National Laboratories is carrying out large-scale tests to study the solar destruction of organics at realistic processing rates in addition to laboratory work aimed at determining the applicability of solar detoxification to the removal of heavy metals. In this paper, we present up-to-date results from Sandia's effort. The large scale tests illustrate the effectiveness of solar detoxification for a variety of organics and compare measured reaction rates against published values of the rate constants for attack by aqueous hydroxyl radicals. This comparison highlights the importance of hydroxyl radical chemistry in solar detoxification processes. It is concluded that solar detoxification is only feasible for easily destroyed compounds like TCE, and PCE. The chlorinated methanes and ethanes are much more difficult to destroy and require very large solar collectors. In the second part of the paper, laboratory data are presented for a variety of different metals, including Ag, Cd, Cu, Hg, Ni, and Pt. The concentration of dissolved oxygen is one of the variables in the study. It is shown that the presence of dissolved metals can have a profound effect on organic oxidation rate, and that oxygen is not necessarily required for oxidation to occur. It is concluded that solar detoxification would be useful for removing mercury and silver but not for copper, nickel nor cadmium. DOE

N92-20268*# Wisconsin Univ., Milwaukee. Space Architecture Design Group.
SPACE ARCHITECTURE MONOGRAPH SERIES. VOLUME 4: GENESIS 2: ADVANCED LUNAR OUTPOST Final Report
Joseph P. Fieber, Janis Huebner-Moths, Kerry L. Paruleski, and Gary T. Moore, ed. 11 Jun. 1991 90 p
(Contract NASw-4435)
(NASA-CR-190027; NAS 1.26:190027; R91-2-Vol-4;
ISBN-0-938744-74-7) Avail: NTIS HC/MF A05 HC first copy free, additional copies $10.00 CSCL 06K

This research and design study investigated advanced lunar habitats for astronauts and mission specialists on the Earth's moon. Design recommendations are based on environmental response to the lunar environment, human habitability (human factors and environmental behavior research), transportability (structural and materials system with least mass), constructability (minimizing extravehicular time), construction dependability and resilience, and suitability for NASA launch research missions in the 21st century. The recommended design uses lunar lava tubes, with construction being a combination of Space Station Freedom derived hard modules and light weight Kevlar laminate inflatable structures. The proposed habitat includes research labs and a biotron, crew quarters and crew support facility, mission control, health maintenance facility, maintenance work areas for psychological retreat, privacy, and comtemplation. Furniture, specialized

equipment, and lighting are included in the analysis and design. Drawings include base master plans, construction sequencing, overall architectural configuration, detailed floor plans, sections and axonometrics, with interior perspectives. Author

N92-20269*# Arizona Univ., Tucson. Dept. of Aerospace and Mechanical Engineering.
THERMAL CONTROL SYSTEMS FOR LOW-TEMPERATURE HEAT REJECTION ON A LUNAR BASE Semiannual Status Report
K. R. Sridhar and Matthias Gottmann Feb. 1992 35 p
(Grant NAG5-1572)
(NASA-CR-190063; NAS 1.26:190063) Avail: NTIS HC/MF A03 CSCL 06K

One of the important issues in the lunar base architecture is the design of a Thermal Control System (TCS) to reject the low temperature heat from the base. The TCS ensures that the base and all components inside are maintained within the operating temperature range. A significant portion of the total mass of the TCS is due to the radiator. Shading the radiation from the sun and the hot lunar soil could decrease the radiator operating temperature significantly. Heat pumps have been in use for terrestrial applications. To optimize the mass of the heat pump augmented TCS, all promising options have to be evaluated and compared. Careful attention is given to optimizing system operating parameters, working fluids, and component masses. The systems are modeled for full load operation. Author

N92-20430*# Prairie View Agricultural and Mechanical Coll., TX. Dept. of Architecture.
MARS HABITAT
Dale Ayers, Timothy Barnes, Woody Bryant, Parveen Chowdhury, Joe Dillard, Vernadette Gardner, George Gregory, Cheryl Harmon, Brock Harrell, and Sherrill Hilton et al 25 Nov. 1991 52 p
(Contract NASw-4435)
(NASA-CR-189985; NAS 1.26:189985) Avail: NTIS HC/MF A04 CSCL 06K

The objective of this study is to develop a conceptual design for a permanently manned, self-sustaining Martian facility, to accommodate a crew of 20 people. The goal is to incorporate the major functions required for long term habitation in the isolation of a barren planet into a thriving ecosystem. These functions include living, working, service, and medical facilities as well as a green house. The main design task was to focus on the internal layout while investigating the appropriate structure, materials, and construction techniques. The general concept was to create a comfortable, safe living environment for the crew members for a stay of six to twelve months on Mars. Two different concepts were investigated, a modular assembly reusable structure (MARS) designated Lavapolis, and a prefabricated space frame structure called Hexamars. Both models take into account factors such as future expansion, radiation shielding, and ease of assembly. Author

N92-20583*# Florida Univ., Gainesville. Dept. of Aerospace Engineering, Mechanics and Engineering Science.
DESIGN OF BIOMASS MANAGEMENT SYSTEMS AND COMPONENTS FOR CLOSED LOOP LIFE SUPPORT SYSTEMS Final Report
Gale E. Nevill, Jr. Jun. 1991 197 p
(Contract NASw-4435)
(NASA-CR-190017; NAS 1.26:190017) Avail: NTIS HC/MF A09 CSCL 06K

The design of a biomass management system (BMS) for use in a closed loop support system is presented by University of Florida students as the culmination of two design courses. The report is divided into two appendixes, each presenting the results of one of the design courses. The first appendix discusses the preliminary design of the biomass management system and is subdivided into five subsystems: (1) planting and harvesting, (2) food management, (3) resource recovery, (4) refurbishing, and (5) transport. Each subsystem is investigated for possible solutions to problems, and recommendations and conclusions for an integrated BMS are discussed. The second appendix discusses the specific design of components for the BMS and is divided into three sections: (1) a sectored plant growth unit with support systems, (2) a container and receiving mechanism, and (3) an air curtain system for fugitive particle control. In this section components are designed, fabricated, and tested. H.A.

N92-20982# Army Natick Labs., MA.
HAND ANTHROPOMETRY OF US ARMY PERSONNEL Final Report, 26 Jun. 1989 - 31 Dec. 1990
Thomas M. Greiner Dec. 1991 425 p
(AD-A244533) Avail: NTIS HC/MF A18 CSCL 05/9

This report presents the results of the analysis of data on the hand gathered during the 1987-1988 anthropometric survey of Army personnel. Data are presented in the form of summary statistics and percentile tables. In addition, correlations, regressions, analyses of variance and principal components for sex and racial groups, nonmetric trait frequencies, and observer error magnitudes are reported. These data summaries are presented for a subset of the actual data base (1003 men and 1304 women) that match the working data bases summarized in the anthropometric survey's final report. Therefore, the hand working data bases match the demographic characteristics of the June 1988 Army, and are comprised of individuals who are in the anthropometric survey's working data bases. The dimensions given in this report include 64 hand measurements that were obtained using a special photometric system. An additional 22 dimensions, obtained through direct measurement during the anthropometric survey, were added to the hand data base. Therefore, a total of 86 dimensions are presented in this report. Measurement descriptions, visual indices, and a glossary are included to aid readers in locating dimensions and in interpreting presentations. GRA

N92-21002# Pacific Northwest Lab., Richland, WA.
EVOLUTION OF THE SOLDIER-MACHINE INTERFACE PROTOTYPE FOR TACTICAL COMMAND AND CONTROL SYSTEMS
S. M. Adams and K. D. Hargrove Nov. 1991 13 p Presented at the Transportable Applications Environment Plus (TAE+) Users Conference, Carrollton, MD, 5-7 Nov. 1991
(Contract DE-AC06-76RL-01830)
(DE92-006486; PNL-SA-19902; CONF-9111172-1) Avail: NTIS HC/MF A03

The U.S. Army Tactical Command and Control System (ATCCS) Experimentation Site (AES) was established to support the evolutionary development, integration, and interoperability experimentation on the ATCCS software with emphasis on the Soldier-Machine Interface and human factors. Activities at the AES include exercising a system in an environment designed to assist experiment proponents and material and combat developers to uncover system problems and make corrections prior to the formal test and evaluation. The Human Factors Guidelines for the Army Tactical Command and Control System (ATCCS) Soldier-Machine Interface were developed as a part of and as a result of this experimentation. The experiment software varies in nature, size, and complexity. The experiments include demonstrating computer displays and obtaining human evaluations about the acceptability of the interface screens. Rapid prototyping techniques allow screens to be altered quickly with instant evaluation of the effects of alternatives on user perceptions. Representative issues include colors and terminology, sequencing of items, methods for interactive control, and navigation through displays. DOE

55 SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

N92-20353*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.
SPACE STATION CENTRIFUGE: A REQUIREMENT FOR LIFE SCIENCE RESEARCH

Arthur H. Smith (California Univ., Davis.), Charles A. Fuller, Catherine C. Johnson, and Charles M. Winget Feb. 1992 27 p Conference held in Davis, CA, Jan. 1986
(NASA-TM-102873; A-90309; NAS 1.15:102873) Avail: NTIS HC/MF A03 CSCL 06A

A centrifuge with the largest diameter that can be accommodated on Space Station Freedom is required to conduct life science research in the microgravity environment of space. (This was one of the findings of a group of life scientists convened at the University of California, Davis, by Ames Research Center.) The centrifuge will be used as a research tool to understand how gravity affects biological processes; to provide an on-orbit one-g control; and to assess the efficacy of using artificial gravity to counteract the deleterious biological effect of space flight. The rationale for the recommendation and examples of using ground-based centrifugation for animal and plant acceleration studies are presented. Included are four appendixes and an extensive bibliography of hypergravity studies. Author

59 MATHEMATICAL AND COMPUTER SCIENCES (GENERAL)

No abstracts in this category.

60 COMPUTER OPERATIONS AND HARDWARE

Includes hardware for computer graphics, firmware, and data processing.

For components see *33 Electronics and Electrical Engineering.*

N92-20170# Technische Univ., Berlin (Germany, F.R.). Fachbereich Informatik.
SECURITY ARCHITECTURE FOR DISTRIBUTED SYSTEMS Ph.D. Thesis [SICHERHEITSARCHITEKTUR FUER VERTEILTE SYSTEME]
Matthias Kaeding 1991 184 p In GERMAN
(ETN-92-91146) Avail: NTIS HC/MF A09

A Subject, Object and Function (SOF) model is developed for the modeling and technical integration of the access control mechanism in a distributed system. A system is defined for the description of the access control ratings of a user, e.g., a subject. The access control system is composed of three system duties which are controlled by a security, and work with logic object marking. The three duties also control the access function realization of an object and the transport of an object within the distributed systems. The field of communication security is covered by known coding processes. ESA

N92-20188# Audesyn, Inc., Edmonton (Alberta). Advanced Technology Centre.
VERIFIABLE HARDWARE SYNTHESIS
J. Brett Hammerlindl and Emil F. Girczyc Mar. 1989 65 p Sponsored by Dept. of National Defence and Dept. of Supply and Services
(AUTR-89-06; CTN-92-60404) Copyright Avail: NTIS HC/MF A04

The Elf system is a production based hardware synthesis system that generates data paths and complex finite state machine descriptions. It uses productions that describe the behavior of cells ranging in complexity from a simple inverter to complex nodule builders. This report demonstrates how a production based synthesis system like Elf can perform verifiable hardware synthesis and why verifiable hardware synthesis can be trusted as a formal method of generating hardware to implement a specification. Verifiable hardware synthesis is the process of formally synthesizing hardware so that the circuit is trusted to be an implementation of a specification. This paper provides an overview of the present Elf system. Two basic approaches to producing verified hardware, hardware verification after manual design, and verifiable hardware synthesis are compared and the superiority of verifiable hardware synthesis is argued. It is shown that a production based synthesis system is analogous to a theorem prover and thus forms a trustworthy base for verifiable hardware synthesis. A review of three sophisticated theorem provers, the Boyer-Moore, the HOL, and the m-NEVER theorem provers, is presented. Aspects of database theory which are applicable to verifiable hardware synthesis are discussed. It is argued that a production based hardware synthesis system such as Elf can perform verifiable hardware synthesis and modifications to Elf required to implement verifiable hardware synthesis are listed. CISTI

N92-20221# National Inst. for Occupational Safety and Health, Cincinnati, OH. Div. of Standards Development and Technology Transfer.
NIOSH PUBLICATIONS ON VIDEO DISPLAY TERMINALS (REVISED)
Jun. 1991 84 p
(PB92-109230) Avail: NTIS HC/MF A05 CSCL 09B

Materials developed by NIOSH concerning video display terminals (VDTs) comprise the publication. Citations are listed of reports developed by NIOSH concerning VDTs and possible hazards associated with their use, and ordering information is given. Types of publications included NIOSH numbered publications, hazard evaluation and technical assistance reports, contract reports, journal articles, book chapters, presentations, and miscellaneous reports. Next, full text copies are given of selected references from the bibliography. These references included testimony before congressional committees, presentations and articles dealing with radiation issues, reproductive outcomes of workers using VDTs the risk of spontaneous abortion, an epidemiologic study of electric and magnetic fields and operator exposure, controlling glare problems in the VDT work environment, and the design of rest break for VDT operators. Author

N92-20879# Applied Silicon, Inc., Ottawa (Ontario).
INVESTIGATION OF ADVANCED SERIAL MEMORY ARCHITECTURES Final Report
Karl Siemens 23 Oct. 1990 76 p Sponsored by Defence Research Establishment
(CTN-92-60449) Avail: NTIS HC/MF A05

A variety of potential architectures are discussed for their applicability to the development of a single-chip digital radio frequency memory (DRFM) for electronic countermeasures applications. Distinct limiting factors involved in DRFM design include the maximum signal digitizing rates and the maximum operating rate of the selected semiconductor technology. Commercial technologies that could be used have liabilities in that high-speed technologies require too much power or are not mature enough to handle large data blocks. Technologies such as complementary metal oxide semiconductors can contain large memories but are too slow for DRFM applications unless great care is taken to demultiplex the incoming signal prior to digitization. It appears that mixed higher- and lower-speed technologies offer the best potential to implement a larger-capacity DRFM with reasonable power consumption. It is recommended that a first generation chip incorporate a modest memory size, interfacing with only a single bit at a time, and that a paired register demultiplexer / multiplexer scheme be investigated further. The memory block size and aspect ratios for any of the configurations under study appear realizable using standard cell design methodology; access speed is not a limitation provided a sufficient data rate reduction is designed into the input/output port demux/mux circuits. Author (CISTI)

N92-20900# Naval Ocean Systems Center, San Diego, CA.
THE UNIFIED NETWORKING TECHNOLOGY ADVANCED TECHNOLOGY DEMONSTRATION (UNT/ATD) NETWORKING PROTOCOLS
C. M. Keune and C. J. Warner Sep. 1991 6 p
(AD-A245089) Avail: NTIS HC/MF A02 CSCL 25/2

The HAMA/MINCAP subnetwork architecture was demonstrated in an Advanced Technology Demonstration (ATD) in September 1990. The following subnetwork protocols were included: the Hand-off Assigned Multiple Access (HAMA) Channel Access Protocol, the Minimum Cover Approximation (MINCAP) Broadcast Routing Protocol, and the Backwards Learning (BL) Point-to-Point Routing Protocol. HAMA is an adaptive time division multiple access-based protocol. HAMA allows a node to temporarily hand-off a time slot to a neighbor with higher priority traffic. MINCAP uses a two hop connectivity matrix and a message history table to select relays. The three or fewer nodes which provide the best coverage of nodes who have not yet received the packet are designated as relays. BL uses a table containing delay information to each node in the network via the various relays available. The relay with the minimum path length is selected. GRA

N92-20935# Helsinki Univ. of Technology, Espoo (Finland).
OPEN SYSTEMS SECURITY: AN ARCHITECTURAL FRAMEWORK Ph.D. Thesis
Arto T. Karila (Telecom Finland, Helsinki.) 1991 143 p Sponsored by Jenny and Antti Wihuri Foundation and the Finnish Cultural Fund
(ISBN-952-90-2783-4; ETN-92-90825) Copyright Avail: NTIS HC/MF A07

An architecture for building secure open systems that can communicate via untrusted global data networks is presented. The work is based on the International Standards Organization Open Systems Interconnection (ISO OSI) reference model and its security architecture addendum. However, several extensions and modifications to the OSI model are suggested. A semi-formal model for the security of communications between peer entities within an OSI layer and between entire application instances is presented. This model, along with some new concepts, is successfully used to analyze the security functions of open systems. This work brings a whole new research area, which is at the boundary between formal protocol research and cryptology, within the reach of formal study. Complete formalization of and further elaboration on the model are beyond the scope of this work and left for further study. The degree of freedom of the OSI security architecture in placing the security services and mechanisms defined in the OSI reference model into its layers is restricted in such a way as to not affect the security of the overall communication service, and well-founded placements for various services and mechanisms are proposed. In order to demonstrate the implementability of the solutions proposed, actual low level security mechanisms are chosen to fill in the missing parts. A communications profile for secure File Transfer, Access and Management (FTAM) is drawn up and a subset of it is implemented based on existing OSI implementations. ESA

N92-20960# Lawrence Livermore National Lab., CA.
THE COMPUTER FRAUD AND ABUSE ACT OF 1986 AND THE COMPUTER SECURITY ACT OF 1987: IMPACT ON INCIDENT RESPONSE EFFORTS
E. E. Schultz 11 Oct. 1991 10 p Presented at the 3rd Workshop on Computer Security Incident Handling, Herndon, VA, 6-8 Aug. 1991
(Contract W-7405-eng-48)
(DE92-007327; UCRL-JC-108516; CONF-9108194-1) Avail: NTIS HC/MF A02

The purpose of this paper is to evaluate two Federal statutes, the Computer Fraud and Abuse Act of 1986 and the Computer Security Act of 1987, from the perspective of computer security incident response efforts. First, the major relevant provisions of each statute are presented. Next, revisions to each statute are proposed, and additional areas needing to be addressed in future legislation are presented. The major conclusion is that these statutes represent a start in the legislative process to deter and prevent computer offenses such as unauthorized access to systems. However, many revisions and additions are needed before such legislation will significantly impact incident response efforts. In addition, legislation alone cannot bring about the degree of change necessary to address the range of computer security threats that presently exist. DOE

N92-20961# Lawrence Livermore National Lab., CA.
THE COMPUTER EMERGENCY RESPONSE TEAM SYSTEM (CERT-SYSTEM)
E. E. Schultz 11 Oct. 1991 6 p Presented at the 14th National Computer Security Conference, Washington, DC, 1-4 Oct. 1991
(Contract W-7405-eng-48)
(DE92-007329; UCRL-JC-108517; CONF-911059-3) Avail: NTIS HC/MF A02

This paper describes CERT-System, an international affiliation of computer security response teams. Formed after the WANK and OILZ worms attacked numerous systems connected to the Internet, an operational charter was signed by representatives of 11 response teams. This affiliation's purpose is to provide a forum for ideas about incident response and computer security, share information, solve common problems, and develop strategies for responding to threats, incidents, etc. The achievements and advantages of participation in CERT-System are presented along with suggested growth areas for this affiliation. The views presented in this paper are the views of one member, and do not necessarily represent the views of others affiliated with CERT-System. DOE

N92-20964# Ballistic Research Labs., Aberdeen Proving Ground, MD.
A COMPUTER-AIDED SYSTEM FOR MEASURING AND RECORDING SHORT TIME INTERVALS Final Report, Oct. 1990 - Sep. 1991
Thomas Kottke Jan. 1992 39 p
(AD-A245031; BRL-MR-3958) Avail: NTIS HC/MF A03 CSCL 12/5

An inexpensive computer-aided system has been developed for the measurement and storage of short time interval data. The use of interchangeable time base oscillators, an open-ended, modular counting architecture, signal processing of user-supplied handshaking signals and regulation of power supply voltage allow systems to be adapted to a wide variety of applications. Construction and assembly of this system is simplified by the use of commercially available PC digital interface boards. Schematic diagrams, complete descriptions of circuit functions, and sample software are included. GRA

N92-20975# Lawrence Livermore National Lab., CA.
COMPUTER SECURITY INCIDENT RESPONSE TEAMS
E. E. Schultz Nov. 1991 10 p Presented at the 1st Advanced Study Institute (AIS) Security Technology for Space Operations Conference, Houston, TX, 6-8 Nov. 1991
(Contract W-7405-eng-48)
(DE92-007346; UCRL-JC-108961; CONF-9111180-1) Avail: NTIS HC/MF A02

The paper discusses computer security incident response teams. Numerous teams have been formed within the Government, commercial, and academic arenas. A major impetus for forming these teams has been the increasing complexity of computer security incidents and problems. The major purpose of these teams is to assist others in responding to computer security incidents, although other purposes may include providing a liaison function with other agencies and teams, conducting training and awareness activities, developing standards and guidelines, developing computer security-related tools, researching vulnerabilities in operating systems and applications, and others. Response teams' activities are dependent on contacts from within a team's constituency, and it is important for users and systems managers to turn to the appropriate response team when reporting information or requesting assistance. Incident response teams have achieved a number of successes to date, and FIRST (Forum on Incident

Response and Security Teams) has been formed to help incident response teams coordinate efforts and improve communication between these teams. DOE

N92-21039# Lawrence Livermore National Lab., CA.
METAWIDGETS IN THE MULTIMODAL INTERFACE
M. M. Blattner, E. P. Glinert, J. A. Jorge, and G. R. Ormsby (Rensselaer Polytechnic Inst., Troy, NY.) 1991 9 p Presented at the CHI 1992, Monterey, CA, 3-7 May 1991
(Contract W-7405-eng-48)
(DE92-002595; UCRL-JC-108649; CONF-9105285-1) Avail: NTIS HC/MF A02

We analyze two intertwined and fundamental issues concerning computer-to-human communication in the multimodal interfaces: the interplay between sound and graphics, and the role of object persistence. Our observations lead us to introduce metawidgets as abstract entities capable of manifesting themselves to users as image, as sound, or as various combinations and/or sequences of the two media. We show examples of metawidgets in action, and discuss mechanisms for choosing among alternative media for metawidget instantiation. Finally, we describe a couple of experimental microworlds we have implemented to test out some of our ideas. DOE

61 COMPUTER PROGRAMMING AND SOFTWARE

Includes computer programs, routines, alogorithms, and specific applications, e.g., CAD/CAM.

N92-20056# Lawrence Livermore National Lab., CA.
DECONVOLUTION/IDENTIFICATION TECHNIQUES FOR NONNEGATIVE SIGNALS
D. M. Goodman and D. R. Yu Nov. 1991 4 p Presented at the 1992 IEEE International Conference on Acoustics, Speech and Signal Processing, San Francisco, CA, 23-26 Mar. 1992
(Contract W-7405-eng-48)
(DE92-005244; UCRL-JC-108920; CONF-920354-3) Avail: NTIS HC/MF A01

Several methods for solving the nonparametric deconvolution/identification problem when the unknown is nonnegative are presented. First we consider the constrained least squares method and discuss three ways to estimate the regularization parameter: the discrepancy principle, Mallow's C(sub L), and generalized cross validation. Next we consider maximum entropy methods. Last, we present a new conjugate gradient algorithm. A preliminary comparison is presented; detailed Monte-Carlo experiments will be presented at the conference. DOE

N92-20061*# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
A PARALLEL ALGORITHM FOR MULTI-LEVEL LOGIC SYNTHESIS USING THE TRANSDUCTION METHOD M.S. Thesis
Chieng-Fai Lim 1991 80 p
(Grant NAG1-613)
(NASA-CR-189925; NAS 1.26:189925) Avail: NTIS HC/MF A05 CSCL 09B

The Transduction Method has been shown to be a powerful tool in the optimization of multilevel networks. Many tools such as the SYLON synthesis system (X90), (CM89), (LM90) have been developed based on this method. A parallel implementation is presented of SYLON-XTRANS (XM89) on an eight processor Encore Multimax shared memory multiprocessor. It minimizes multilevel networks consisting of simple gates through parallel pruning, gate substitution, gate merging, generalized gate substitution, and gate input reduction. This implementation, called Parallel TRANSduction (PTRANS), also uses partitioning to break large circuits up and performs inter- and intra-partition dynamic load balancing. With this, good speedups and high processor efficiencies are achievable without sacrificing the resulting circuit quality. Author

N92-20073# Audesyn, Inc., Edmonton (Alberta). Advanced Technology Centre.
ELF HARDWARE SYNTHESIS SYSTEM HARDWARE ALLOCATION USER'S GUIDE, VERSION 2.3.0
W. Lloyd Elwood Mar. 1989 76 p Sponsored by Dept. of National Defence
(AUTR-89-04; CTN-92-60402) Copyright Avail: NTIS HC/MF A05

Elf is a verifiable high level synthesis system for the design of trusted controllers for electronic circuits. It converts an Euclid Version 2 (EV2) program into a circuit specification capable of realizing the functionality of the program description. Once a valid EV2 file has been written, the allocation of this program, from the control/data flow graph (CDFG) is possible. Elf will convert it into an intermediate form of the final circuit known as the circuit graph (CG). The CG is then converted into one of several circuit design formats suitable for fabrication and simulation. Formats supported include MOD, ALLOC, Electronic Data Interchange format (EDIF) level 2, EDIF level 0, and network description language (NDL). This document describes the allocation of a CDFG generated from an EV2 program, to a circuit description in any of the supported formats. CISTI

N92-20117# Oak Ridge National Lab., TN.
GRAPHICAL DEBUGGING OF COMBINATIONAL GEOMETRY
T. J. Burns and M. S. Smith 1992 9 p Presented at the Meeting on New Horizons in Radiation Protection and Shielding, Pasco, WA, 26 Apr. - 1 May 1992
(Contract DE-AC05-84OR-21400)
(DE92-006415; CONF-920431-8) Avail: NTIS HC/MF A02

A graphical debugger for combinatorial geometry being developed at Oak Ridge National Laboratory is described. The prototype debugger consists of two parts: a FORTRAN-based 'view' generator and a Microsoft Windows application for displaying the geometry. Options and features of both modules are discussed. Examples illustrating the various options available are presented. The potential for utilizing the images produced using the debugger as a visualization tool for the output of the radiation transport codes is discussed as is the future direction of the development. DOE

N92-20163# Norwegian Defence Research Establishment, Kjeller.
CESAR HARDWARE DEBUGGING MONITOR: USER'S GUIDE
Kjell Olav Arntzen and Svein-Erik Soegaard 9 Aug. 1991 64 p
(FFI-91/7014; ISSN-0802-2437; ETN-92-90812) Avail: NTIS HC/MF A04

The tools for debugging and verification of the hardware modules in the CESAR system are described. The utility module, memory module, interactive hardware debugger, and the MALU (compute part) test module are described. ESA

N92-20171# Technische Univ., Berlin (Germany, F.R.). Fachbereich Informatik.
AUTOMATIC HIGH LEVEL SYNTHESIS OF REGISTER TRANSFER STRUCTURES, FROM ALGORITHMIC BEHAVIOR DESCRIPTIONS Ph.D. Thesis [AUTOMATISCHE ZUSTANDSSYNTHESE VON REGISTERTRANSFER-STRUKTUREN AUS ALGORTIHMISCHEN VERHALTENSBESCHREIBUNGEN]
Michael Sperling 1991 176 p In GERMAN
(ETN-92-91148) Avail: NTIS HC/MF A09

The current techniques of the Integrated Circuit (IC) project and the procedure of the various types of design tool are described. The register transfer synthesis algorithms are explained and their properties are compared. A new approach to high level synthesis is reported. A new type of model for the representation of the possible variants of a project is introduced with its mathematical

principles. The prototype realization of a behavioral computer for high level synthesis using this model is described. The advantages of the projects with regard to other tool solutions are given.
ESA

N92-20186# Audesyn, Inc., Edmonton (Alberta). Advanced Technology Centre.
A USER'S GUIDE FOR THE MANAGEMENT OF CELL LIBRARIES FOR THE ELF HARDWARE SYNTHESIS SYSTEM, VERSION 2.3.0
J. Brett Hammerlindl and Emil F. Girczyc Mar. 1989 45 p Sponsored by Dept. of National Defence and Dept. of Supply and Services
(AUTR-89-01; AUTR-89-02; CTN-92-60399) Copyright Avail: NTIS HC/MF A03

Elf is a verifiable high level synthesis system for the design of trusted controllers for electronic circuits. Cell libraries and the software that manages them have an essential role in the Elf system. They contain all the technology dependent data that Elf requires to synthesize a circuit. Each cell library contains one or more cell descriptions and one or more datatype definitions. Elf's major use of cell libraries is as a source for terminal productions. Elf applies terminal productions to unallocated control data flow graphs (CDFG) produced by the Euclid Version 2 (EV2) compiler. A complete circuit description is produced from the allocated CDFG and the cell libraries. This document acts as a user guide for users of Elf cell libraries. Included are: a description of the software used to manage cell libraries; the format of cell libraries; use of the editor in cell library maintenance; procedures used in creating or revising existing cell libraries available to the synthesis routine; and the interface with the LSI design system. CISTI

N92-20187# Audesyn, Inc., Edmonton (Alberta). Advanced Technology Centre.
ELF HARDWARE SYNTHESIS SYSTEM HARDWARE ALLOCATION REFERENCE MANUAL, VERSION 2.3.0
W. Lloyd Elwood Mar. 1989 37 p Sponsored by Dept. of National Defence
(AUTR-89-04; AUTR-89-05; CTN-92-60403) Copyright Avail: NTIS HC/MF A03

Elf is a verifiable high level synthesis system for the design of trusted controllers for electronic circuits. It converts an Euclid Version 2 (EV2) program into a circuit specification capable of realizing the functionality of the program description. It runs in a LISP environment. This document describes Elf commands and the interface available to the user. The input and output of Elf is via a UNIX file system. Elf supports several output formats. The intermediate form of the circuit designed by Elf can be written to a user owned file, in level 2 electronic design interchange format (EDIF), level 0 EDIF, and network description language (NDL) formats. CISTI

N92-20253# Florida State Univ., Tallahassee. Dept. of Computer Science.
JAPANESE ADVANCES IN FUZZY SYSTEMS AND CASE-BASED REASONING
D. G. Schwartz Nov. 1991 52 p
(PB92-115443) Avail: NTIS HC/MF A04 CSCL 09B

A survey and assessment is presented of fuzzy systems and case based reasoning research in Japan. Fuzzy logic controllers are examined. Other developments are surveyed on activities at various societies, research institutes, universities, and corporate labs. Current activity in case based reasoning is also surveyed. A few summary reflections are offered, including conjectures on why the Japanese have outstripped their western counterparts in this domain, together with some suggestions on what the U.S. might do to catch up. An appendix contains a bibliography of all materials collected by the author, plus names and addresses of most of the people he met. Author

N92-20272# Audesyn, Inc., Edmonton (Alberta). Advanced Technology Centre.
ENHANCEMENTS TO THE ELF HARDWARE SYNTHESIS SYSTEM
Emil F. Girczyc, W. Lloyd Elwood, Tai A. Ly, and J. Brett Hammerlindl Mar. 1989 80 p Sponsored by Dept. of National Defence
(AUTR-89-06; CTN-92-60397) Copyright Avail: NTIS HC/MF A05

This paper describes extensions to the Elf verifiable high level synthesis system. The original Elf system was capable of generating circuits to implement algorithms described in a subset of the Euclid Version 2 (EV2) programming language. Several major extensions to the original Elf system have been made. Extensions were made to allow Elf to include cells which operate and store data; allocation routines were extended to reduce the number of timing constraints which are violated; between each allocation iteration, analysis is performed to remove underutilized components and interconnections. The utilization of each circuit element is determined and any element utilized less than an acceptable threshold is removed. The software was extended to allow Elf to cascade sequential operations asynchronously within a single control state. This served to reduce the area of both the datapath and controller of the circuit. A number of low level issues were identified which must be considered during high level synthesis. Elf software was extended to consider a more detailed level of timing during allocation, and to allow the specification of electrical parameters of the circuit's interface. An interface was developed from Elf to the LSI Logic gate array software. This interface was demonstrated by having Elf design a nontrivial circuit and then transferring the design to LSI logic where it was simulated and layed out using LSI Logic software. CISTI

N92-20285 Case Western Reserve Univ., Cleveland, OH.
COMPUTER FORMAL DRAWINGS AND THEIR AUTOMATION Ph.D. Thesis
Chen Ding 1991 319 p Sponsored by Wong (K. C.) Educational Foundation
Avail: Univ. Microfilms Order No. DA9137044

Pictures are an important communication medium; but generating pictures in a computer system is tedious and time consuming. Besides, many other problems are found in using pictures. This work aims to (1) develop models to formalize the objects to be visualized and the pictures that visualize them; (2) use visualization schemes to solve the automatic visualization problem; (3) use aesthetics rules to solve the aesthetics problem; and (4) build a system to automate the process of generating computer drawings. The Formal Drawing Model was developed which formalizes computer drawings without losing visual reality. Elements in the Formal Drawing Model possess formal syntax and semantics. The model is powerful enough to accommodate a large variety of computer drawings. What makes a picture pleasing and the mechanisms affecting the efficiency of using pictures to convey information is examined in detail. Aesthetics rules, distilled from numerous diagram drawings in textbooks, are the key component in the automatic drawing system proposed. Based on this work, a framework was built to automate diagram drawing. Four issues are stressed: appropriate user involvement; user customization; efficiency; and aesthetics. Dissert. Abstr.

N92-20328# National Inst. of Standards and Technology, Boulder, CO.
TIME DOMAIN FREQUENCY STABILITY CALCULATED FROM THE FREQUENCY DOMAIN DESCRIPTION: USE OF THE SIGINT SOFTWARE PACKAGE TO CALCULATE TIME DOMAIN FREQUENCY STABILITY FROM THE FREQUENCY DOMAIN
F. L. Walls, J. Gary, A. OGallagher, R. Sweet, and L. Sweet Sep. 1991 39 p
(PB92-123132; NISTIR-89/3916-Rev) Avail: NTIS HC/MF A03 CSCL 09B

The use is described of SIGNIT, an interactive software package which facilitates the calculation of time domain frequency

stability from frequency domain data as a function of measuring time in terms of either the Allan variance (sigma squared sub y(tau)); the modified Allan variance, mod(sigma squared sub y(tau)); or sigma squared sub y(tau) = tau/square root of 3 mod sigma squared sub y(tau). Except for the graphic output, the code is written in standard FORTRAN 77 and runs on AT compatible computers that have a math coprocessor. It also runs on many other systems; however, calls to an available graphics library will need to be substituted for those that are included in this version. The program uses either a user defined function for the input noise or default functions that describe the noise types commonly found in oscillators, amplifiers, frequency multipliers, frequency dividers, and general signal processing equipment including up to four coherent bright lines in the noise spectra. These default functions make it simple to analyze the time domain frequency stability as a function of measuring bandwidth using realistic first, second, or third order low pass filters or the simplified infinitely sharp cutoff parameters. The default functions are also set up to examine the effect of various servo parameters on the performance of a frequency source locked to a frequency reference. Author

N92-20362* Case Western Reserve Univ., Cleveland, OH.
A LARGE-GRAIN MAPPING APPROACH FOR MULTIPROCESSOR SYSTEMS THROUGH DATA FLOW MODEL Ph.D. Thesis
Hwa-Soo Kim 1991 187 p
(Grant NAG3-1103)
(NASA-CR-189969; NAS 1.26:189969) Avail: Univ. Microfilms Order No. DA9137042 CSCL 09B

A large-grain level mapping method is presented of numerical oriented applications onto multiprocessor systems. The method is based on the large-grain data flow representation of the input application and it assumes a general interconnection topology of the multiprocessor system. The large-grain data flow model was used because such representation best exhibits inherited parallelism in many important applications, e.g., CFD models based on partial differential equations can be presented in large-grain data flow format, very effectively. A generalized interconnection topology of the multiprocessor architecture is considered, including such architectural issues as interprocessor communication cost, with the aim to identify the 'best matching' between the application and the multiprocessor structure. The objective is to minimize the total execution time of the input algorithm running on the target system. The mapping strategy consists of the following: (1) large-grain data flow graph generation from the input application using compilation techniques; (2) data flow graph partitioning into basic computation blocks; and (3) physical mapping onto the target multiprocessor using a priority allocation scheme for the computation blocks. Dissert. Abstr.

N92-20374*# Illinois Univ., Urbana-Champaign. Coordinated Science Lab.
PERFORMANCE EVALUATION OF REDUNDANT DISK ARRAY SUPPORT FOR TRANSACTION RECOVERY
Antoine N. Mourad, W. Kent Fuchs, and Daniel G. Saab Dec. 1991 28 p
(Contract NAG1-613; N00014-91-J-1283)
(NASA-CR-189914; NAS 1.26:189914; UILU-ENG-91-2249; CRHC-91-28) Avail: NTIS HC/MF A03 CSCL 09B

Redundant disk arrays provide a way of achieving rapid recovery from media failures with a relatively low storage cost for large scale data systems requiring high availability. Here, we propose a method for using redundant disk arrays to support rapid recovery from system crashes and transaction aborts in addition to their role in providing media failure recovery. A twin page scheme is used to store the parity information in the array so that the time for transaction commit processing is not degraded. Using an analytical model, we show that the proposed method achieves a significant increase in the throughput of database systems using redundant disk arrays by reducing the number of recovery operations needed to maintain the consistency of the database. Author

N92-20413# Audesyn, Inc., Edmonton (Alberta). Advanced Technology Centre.
THE REFERENCE MANUAL FOR THE MANAGEMENT OF CELL LIBRARIES FOR THE ELF HARDWARE SYNTHESIS SYSTEM, VERSION 2.3.0
J. Brett Hammerlindl and Emil F. Girczyc Mar. 1989 18 p Sponsored by Dept. of National Defence
(AUTR-89-02; CTN-92-60400) Copyright Avail: NTIS HC/MF A03

Elf is a production based verifiable high level synthesis system for the design of trusted controllers for electronic circuits. Cell libraries and the software that manages them have an essential role in the Elf system. They contain all the technology dependent data that Elf requires to synthesize a circuit. This document is the reference manual for the management of cell libraries for the Elf production based hardware synthesis system. Elf stores its cell libraries in the Electronic Data Interchange format (EDIF) version 2.0. Generic cell descriptions are allowed but user defined keywords are not supported. Elf extensions to EDIF are described. These are principally new forms used to describe the functionality of a cell to Elf. CISTI

N92-20414# Audesyn, Inc., Edmonton (Alberta). Advanced Technology Centre.
ELF HARDWARE SYNTHESIS SYSTEM EV2 TO CDFG LANGUAGE TRANSLATOR: USER'S GUIDE AND LANGUAGE REFERENCE MANUAL, VERSION 2.3.0
W. Lloyd Elwood Mar. 1989 32 p Sponsored by Dept. of National Defence
(AUTR-89-03; CTN-92-60401) Copyright Avail: NTIS HC/MF A03

Elf is a verifiable high level synthesis system for the design of trusted controllers for electronic circuits. It converts an Euclid Version 2 (EV2) program into a circuit specification capable of realizing the functionality of the program description. This document defines the subset and extensions to the EV2 programming language recognized by the Elf hardware synthesis system. A user's guide is included. Extensions, including subtypes, timing constraints, precedence and input output (I/O) pin declarations, have been added to the EV2 language to make it more suitable for hardware synthesis. Subtypes impose finite subranges on declared types. This information allows Elf to determine the appropriate hardware cell attributes required to realize operation on objects declared to be of these subtypes. Elapsed time between externally visible events on the synthesized hardware is specified by timing constraints which apply to I/O operators. Timing constraints are also applicable to user defined procedures and loops. Definition of precedence edges within an EV2 program is an Elf extension which allows the user to specify the order of user defined operators. All externally visible communication occurs via these I/O operators. These operators are bound to specific pad channels via I/O pin placement declaration. The user must define all EV2 read or write operations or import them by including a file of standard I/O operators. CISTI

N92-20419*# Pennsylvania Univ., Philadelphia. Dept. of Bioengineering.
SEPARABILITY OF SPATIOTEMPORAL SPECTRA OF IMAGE SEQUENCES Ph.D. Thesis
Michael P. Eckert, Gershon Buchsbaum, and Andrew B. Watson (National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.) 23 Mar. 1992 16 p Submitted for publication
(Grants NGT-50523; NSF 83-51637; AF-AFOSR-0082-91)
(NASA-CR-190111; NAS 1.26:190111) Avail: NTIS HC/MF A03 CSCL 09B

The spatiotemporal power spectrum was calculated of 14 image sequences in order to determine the degree to which the spectra are separable in space and time, and to assess the validity of the commonly used exponential correlation model found in the literature. The spectrum was expanded by a Singular Value Decomposition into a sum of separable terms and an index was defined of spatiotemporal separability as the fraction of the signal

energy that can be represented by the first (largest) separable term. All spectra were found to be highly separable with an index of separability above 0.98. The power spectra of the sequences were well fit by a separable model. The power spectrum model corresponds to a product of exponential autocorrelation functions separable in space and time. Author

N92-20457# Gesellschaft fuer Mathematik und Datenverarbeitung, Saint Augustin (Germany, F.R.).
SUPPORTING THE ACQUISITION OF NEW CONCEPTS FROM NATURAL LANGUAGE TEXTS WITH A MEANING DICTIONARY
K. Haenelt 1991 13 p
(PB92-114727; GMD-578) Copyright Avail: NTIS HC/MF A03 CSCL 09B

For the KONTEXT text analysis system, an organization of background knowledge was developed which supports the establishment of new concepts during text analysis. Instead of a domain knowledge base, a 'meaning dictionary' is used as a starting set of dynamic background modeling. First, the KONTEXT dictionary is introduced. Advantages of basing conceptual modelings on definitions of a meaning dictionary are explained and an example of acquiring conceptual definitions from a meaning dictionary is given. Then, the application of the KONTEXT dictionary in text analysis is discussed. The extent to which the meaning dictionary supports the acquisition of new concepts from natural language texts is shown. While a certain degree of creativity in the use of language can be modeled by possible combinations of dictionary entries, a further degree is achieved by operating texturally on these entries. An example of this is given. Author

N92-20474# National Aerospace Lab., Amsterdam (Netherlands). Informatics Div.
SCIENTIFIC COMPUTING ENVIRONMENT DERIVED FROM MILITARY AND SPACE APPLICATIONS
W. Loeve 7 Mar. 1990 18 p Presented at the High-Technology Spin-Off, Brussels, Belgium, 19-20 Mar. 1990
(NLR-TP-90082-U; ETN-92-90964) Avail: NTIS HC/MF A03

A scientific computing environment based on techniques for control and technical software development, that were applied in the development and maintenance of a local military command and control system and of a system for ground operations of a spacecraft, is described. The environment contains a prescribed baseline to be used as a reference in control mechanisms, and a prescribed set of steps and related products for choice of hardware and for software development. The environment makes it possible to realize a cooperation of managers, scientists engineers and computer sientists in the development and change control of scientific software. Application of the environment is illustrated by means of a realized computer network and an information system for flow simulation. ESA

N92-20501# Center for Mathematics and Computer Science, Amsterdam (Netherlands). Dept. of Computer Science.
BRANCHING TIME AND ABSTRACTION IN BISIMULATION SEMANTICS
Rob J. vanGlabbeek and W. Peter Weijland Mar. 1991 55 p Sponsored by Commission of the European Communities and Technische Univ.
(CWI-CS-R9120; ETN-92-90559) Copyright Avail: NTIS HC/MF A04

In comparative concurrency semantics a distinction is usually made between linear time and branching time semantic equivalences. Milner's notion of observation equivalence is often mentioned as the standard example of a branching time equivalence. An investigation as to whether observation equivalence really does respect the branching structure of processes is made and it is found that in the presence of unobservable action this is not the case. Therefore the notion of branching bisimulation equivalence is introduced which strongly preserves the branching structure of processes, in the sense that it preserves computations together with the potentials in all intermediate states that are passed through even if silent moves are involved. On closed CCS terms branching bisimulation can be completely axiomized by the single axiom scheme: a.(tau.(y+z)+y) a.(y+z) (where a ranges over all actions) and the usual laws for strong congruence. For a large class of processes it turns out that branching bisimulation and observation equivalence are the same. All protocols known to the authors that were verified in the setting of observation equivalence happen to fit in this class, and hence are also valid in the stronger setting of branching bisimulation equivalence. ESA

N92-20549*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
EXPERT SYSTEM VERIFICATION AND VALIDATION STUDY. DELIVERY 3A AND 3B: TRIP SUMMARIES
Scott French (International Business Machines Corp., Houston, TX.) 23 Aug. 1991 15 p
(Contract NCC9-16; RICIS Proj. AL-16)
(NASA-CR-189942; NAS 1.26:189942) Avail: NTIS HC/MF A03 CSCL 09B

Key results are documented from attending the 4th workshop on verification, validation, and testing. The most interesting part of the workshop was when representatives from the U.S., Japan, and Europe presented surveys of VV&T within their respective regions. Another interesting part focused on current efforts to define industry standards for artificial intelligence and how that might affect approaches to VV&T of expert systems. The next part of the workshop focused on VV&T methods of applying mathematical techniques to verification of rule bases and techniques for capturing information relating to the process of developing software. The final part focused on software tools. A summary is also presented of the EPRI conference on 'Methodologies, Tools, and Standards for Cost Effective Reliable Software Verification and Validation. The conference was divided into discussion sessions on the following issues: development process, automated tools, software reliability, methods, standards, and cost/benefit considerations. . E.R.

N92-20564*# Research Inst. for Advanced Computer Science, Moffett Field, CA.
IN THE SOFT-TO-HARD TECHNICAL SPECTRUM: WHERE IS SOFTWARE ENGINEERING?
Theodore F. Leibfried and Robert B. MacDonald (Houston Univ., Clear Lake, TX.) 12 Feb. 1992 19 p
(Contract NCC9-16)
(NASA-CR-189937; NAS 1.26:189937) Avail: NTIS HC/MF A03 CSCL 09B

In the computer journals and tabloids, there have been a plethora of articles written about the software engineering field. But while advocates of the need for an engineering approach to software development, it is impressive how many authors have treated the subject of software engineering without adequately addressing the fundamentals of what engineering as a discipline consists of. A discussion is presented of the various related facets of this issue in a logical framework to advance the thesis that the software development process is necessarily an engineering process. The purpose is to examine more of the details of the issue of whether or not the design and development of software for digital computer processing systems should be both viewed and treated as a legitimate field of professional engineering. Also, the type of academic and professional level education programs that would be required to support a software engineering discipline is examined. Author

N92-20566# Rice Univ., Houston, TX.
RESEARCH ON TRUST-REGION ALGORITHMS FOR NONLINEAR PROGRAMMING
J. E. Dennis and R. A. Tapia Nov. 1991 7 p
(Contract DE-FG05-86ER-25017)
(DE92-005466; DOE/ER-25017/5) Avail: NTIS HC/MF A02

The development and testing of effective global algorithms for general nonlinear programming problems is discussed. Research in the following areas is presented: interior-point methods for linear programming; trust-region SQP Newton's method for general

nonlinear programming problems; trust-region SQP Newton's method for large sparse nonlinear programming problems with applications to oil reservoir management; a unified approach to global convergence of trust-region methods for nonsmooth optimization; and SQP augmented Lagrangian BRGS algorithm for constrained optimization. DOE

N92-20589 Centre National d'Etudes Spatiales, Toulouse (France).
THE MANAGEMENT OF LARGE SOFTWARE PROJECTS IN THE SPACE INDUSTRY
Jun. 1991 467 p In ENGLISH and FRENCH Symposium held in Toulouse, France, 16-18 Oct. 1990 Previously announced in IAA as A91-47751
(ISBN-2-85428-277-9; ISSN-0766-1002; ETN-92-90753)
Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

Various aspects of software development and management for space applications are discussed. Techniques and tools for specifications, design, and development are studied. Integration, validation, and computer languages particularly suited to real time tasks are discussed. The organization and management of software development programs is given particular attention. The role of quality control and difficulties encountered in cooperative ventures are discussed. The use of large scale software is studied at length. Ergonomics and training of both users and maintenance personnel are discussed. For individual titles, see N92-20590 through N92-20629.

N92-20590 Electronique Serge Dassault, Saint Cloud (France).
SPACE SOFTWARE IS FIRST OF ALL SOFTWARE [LE LOGICIEL SPATIAL EST D'ABORD DU LOGICIEL]
Philippe Lorier and Bruno Mehu *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 23-32 In FRENCH; ENGLISH summary Previously announced in IAA as A91-47752 (For primary document see N92-20589 11-61)
Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

The use of software tools and methods in avionics and space applications is discussed. Similarities between the software used in these two domains is pointed out. Experience gained with software carried on the SPOT 2 and 3 satellites and on Helios, is described. Experience gained with calculation software on Mirage F1, Mirage 2000, and Rafale fighters is summarized. Software specifications, software validation tests, and configuration management are discussed in view of the experience gained in both the avionic and space software systems. ESA

N92-20591 Aeritalia S.p.A., Turin (Italy). Space Systems Group.
SOFTWARE INTEGRATION, VERIFICATION, AND QUALIFICATION FOR MANNED SPACE LABORATORIES: STRATEGIES AND TECHNIQUES
Nicholas Innes and Lorenzo Sarlo *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 33-45 Previously announced in IAA as A91-47753 (For primary document see N92-20589 11-61)
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The increasing role of software in manned spacecraft means that software forms a major system component within the entire system development life cycle, both on ground and in orbit. For manned space laboratories the use of software is even greater. Requirements placed upon these systems, in terms of autonomy and support to crew performance, are summarized. The Integration, Verification, and Qualification (IVQ) of such large, complex software systems, containing safety and/or operational critical software is discussed. Human system interface and support software, having a long expected operational life, presents some demanding challenges to the developing organizations. The success of the IVQ program is imperative for the success of the program as a whole. Some strategies and approaches to the management and implementation of the IVQ process are presented. The strategic allocation of IVQ resources throughout the software development lifecycle is examined. The role of software IVQ activities in relation to other system level and subcontractor activities is discussed and recommendations are made as to how these relationships can be made more effective for the implementation of a comprehensive IVQ program. The approach taken to the performance of IVQ activities is discussed, and ways in which the subcontractor integrator relationship can be made complementary are outlined. ESA

N92-20592 European Space Agency. European Space Research and Technology Center, ESTEC, Noordwijk (Netherlands).
EXPERIENCES GAINED FROM THE ERS-1 INSTRUMENT SOFTWARE DEVELOPMENT
M. Pollina and K. Hjortnaes *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 47-58 Previously announced in IAA as A91-47754 (For primary document see N92-20589 11-61)
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The experiences gained during the overall design and development of the instruments for the ERS-1 satellite are summarized. Systems and software requirements, software validation and testing, and software maintenance are discussed. A classical approach for software validation and testing was adopted for the ERS-1 instruments. It consists of module testing, integration onto the target system, and instrument level tests. This strategy for test and integration causes difficulties for qualifying real time embedded software: incircuit emulators have limited facilities for exercising in real time and simultaneously monitoring the embedded software; it is often impossible to reproduce a test 100; it is difficult to create a 'worst case' test; and it is difficult to exercise execution handling in the software. Ways in which to overcome these difficulties are summarized. ESA

N92-20593 MATRA Espace, Toulouse (France).
INTEGRATION AND VALIDATION OF ONBOARD SPACE SOFTWARE [INTEGRATION ET VALIDATION DES LOGICIELS EMBARQUES SPATIAUX]
Herve Costard *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 59-66 In FRENCH Previously announced in IAA as A91-47755 (For primary document see N92-20589 11-61)
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The reliability of onboard software is discussed. The integration philosophy and validation of the central flight control software of the SPOT 4 satellite are described. The current life cycle is discussed and the methodology used during the testing phase is described. The tight link between the test methodology software and the general satellite integration philosophy is highlighted. The problems involved with validating future European space systems are reviewed. ESA

N92-20594 Centre National d'Etudes Spatiales, Toulouse (France).
SUMMARY OF THE SIGMA FLIGHT SOFTWARE DEVELOPMENT. CONFERENCE PRESENTATION: LARGE SOFTWARE PROJECT MANAGEMENT [SYNTHESE SUR LE DEVELOPPEMENT DU LOGICIEL DE VOL SIGMA. PRESENTATION AU COLLOQUE: GESTION DES GRANDS PROJETS LOGICIELS]
O. Boutemy *In its* The Management of Large Software Projects in the Space Industry Jun. 1991 p 67-77 In FRENCH; ENGLISH summary Previously announced in IAA as A91-47756 (For primary document see N92-20589 11-61)
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The GRANAT satellite carries several astronomy instrument packages including the French telescope Sigma. Acceptance tests performed during the three months following the launch and the operational phase started in March 1990 are described. The development of the onboard software responsible for the payload

is described in detail. The methods, tools, and languages used and their contribution in the context of the development, their shortcomings, the difficulties encountered, the backups to previous steps which were made necessary, and the actual duration of each phase compared with those initially predicted at the beginning of the project are described. An analysis of the events which on several occasions, caused changes to be made to the initial software design is presented. Analysis of the causes or origins of specification modifications and the phases in which they occurred are presented. The anomalies detected and their type, rate and more particularly, those discovered in the last phases of development are summarized. The advantages of a real time multitasking executive in taking into account last minute modification to the real time specification are pointed out. ESA

N92-20595 Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.).
ON EXPERIENCE IN MODELLING OF SYSTEM'S OPERATIONAL BEHAVIOUR
Rainer Gerlich *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 79-89 Previously announced in IAA as A91-47757 (For primary document see N92-20589 11-61)
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Software modification limitations over the lifecycle of a project are outlined. Software is used to compensate for anomalies caused by hardware design errors which cannot be removed from the hardware. The hard assumptions on which software is based, which make last minute software modifications difficult, are summarized. The fact that nearly all software projects try to develop a complete new system which has never been defined before is identified as one of the reasons for software development involving such high risks. System modeling and prototyping is recommended to reduce the risks involved in software development. ESA

N92-20596 Alcatel Espace, Toulouse (France).
PAYLOAD INTEGRATION SOFTWARE TOOLS [OUTILS LOGICIELS D'INTEGRATION DE CHARGES OUTILS]
J. C. Lestriez *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 91-109 In FRENCH; ENGLISH summary Previously announced in IAA as A91-47758 (For primary document see N92-20589 11-61)
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Two software packages were designed by Alcatel Espace for use in payload integration. The first one, SALOME, is a reusable 'tool box' which allows payload emulation and parameters measurement, with a great emphasis on the system ergonomy. The second one, SACRE, computes and sorts all the usable paths through the repeater schematic. Using a test-rule base, it optimizes the integration test matrix. ESA

N92-20597 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
DESIGN AND INTEGRATION OF AIRBORNE SYSTEMS EXPERIENCE OF AVIONICS SYSTEMS DEVELOPMENT AT DASSAULT AVIATION, SAINT-CLOUD, FRANCE
J. Sass and J. L. Jarrige *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 111-120 Previously announced in IAA as A91-47759 (For primary document see N92-20589 11-61)
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Digital technologies are increasingly used in the fabrication of complex airborne systems. As a consequence, software is present in most new equipment. Also, digital bus techniques are expanding. The general trend toward integration of functions makes it more difficult to assign a specific function to one piece of equipment. This trend is confirmed by the proliferation of artificial intelligence, the generalization of distributed processing, and networking. The system architect must combine technical constraints with an increasingly complex set of customer requirements in terms of performance, safety, maintenance, and flexibility. At the same time, development costs must be controlled. Addressing complex technical issues, yet maintaining reasonable costs, calls for a strict system development methodology supported by appropriate tools. The implementation of such a methodology is presented. ESA

N92-20598 TRASYS Space, Brussels (Belgium).
PETRI NETS FOR MODELLING DYNAMIC CHARACTERISTICS IN HOOD
H. vanBeirendonck, J. Beaufays, S. VanBaelen, and K. DeVlaminck *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 121-129 Previously announced in IAA as A91-47760 Prepared in cooperation with Katholieke Univ. te Leuven, Belgium (For primary document see N92-20589 11-61)
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The Petri net formalism provides a graphical aid to describe the control flow of asynchronous and/or concurrent systems. Three design aspects which can be addressed when using Petri nets in design modeling, analysis, and simulation are described. Integrating HOOD and Petri nets is shown to benefit the lack of duality typical of Petri net structures and provide HOOD with a formal method to express dynamic characteristics. A strategy to introduce Petri nets in order to describe the control structure of active objects in HOOD is presented. ESA

N92-20599 Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.). Applied Data Systems Div.
INTRODUCTION AND APPLICATION OF SOFTWARE ENGINEERING TECHNIQUES TO LARGE SOFTWARE PROJECTS
G. Pawlitzek and E. Mikusch *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 131-153 Previously announced in IAA as A91-47761 Sponsored by DLR (For primary document see N92-20589 11-61)
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Development of the Ground Support Program Equipment (GSPE) for the medical space experiment Anthrorack and the development of a dedicated Experiment Data Simulator (EDS) for testing the GSPE are described. A brief description of the major system aspects of the GSPE is presented. Data acquisition, processing, storage, and quicklock display are summarized. Evaluation of scientific data is discussed. Distributed processing with complex external and internal interfaces is considered. The applied strategy and the lessons learned when introducing software engineering methods, techniques, and tools in the project are described. The techniques and tools used within each phase of the life cycle for the entire project, and within the subproject oriented towards Computer Aided Software Engineering (CASE) is presented. Problems, advantages and disadvantages of the applied techniques and tools are highlighted, stressing their impact on the application of CASE to future projects. ESA

N92-20600 European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).
DEVELOPMENT OF A CONFIGURABLE INFRASTRUCTURE FOR THE CONTROL OF A LARGE VARIETY OF SPACECRAFT: THE SCOS
B. Mullet *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 155-165 Previously announced in IAA as A91-47762 (For primary document see N92-20589 11-61)
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Aspects specific to the development of infrastructure software systems are outlined. Guidelines and recommendations which have been adopted for the SCOS (Spacecraft Control and Operation System) project or which are deduced from the experience gained in the ongoing course of the project are presented. The SCOS example demonstrated that the initial cost overhead implied by

the increased project complexity is largely compensated by the advantage of re-using and maintaining a single large system kernel for 3 or more missions. ESA

N92-20601 European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).
THE INTEGRATION AND TEST OF MODERN SPACECRAFT CONTROL SYSTEMS **c63**
N. Head and M. Jones *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 167-174 Previously announced in IAA as A91-47763 (For primary document see N92-20589 11-61)
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The implementation and testing of modern spacecraft control systems as a major part of overall ground segment preparation efforts are discussed. As spacecraft become more complex and their operations more ambitious, the scope of the control systems required to support them is increasing. Modern spacecraft are characterized by increasingly intensive launch and early orbit phase operations, complex and lengthy checkout and calibration activities and autonomous, frequently isolated, nominal operations. Multiple telemetry data rates and formats are a normal part of a mission as are command modes both with and without the assistance of onboard software. The extent of the differences between these various mission phases and the resulting differences in the operational modes of the ground segment (including the spacecraft control system) are summarized. Difficulties encountered, if the traditional approach to testing a control system is followed, are summarized. ESA

N92-20602 MATRA Espace, Toulouse (France).
DEVELOPMENT OF THE SPOT 4 SOFTWARE VERIFICATION BENCH [DEVELOPPEMENT DU BANC DE VALIDATION LOGICIEL SPOT 4]
Didier Zeller *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 175-184 In FRENCH; ENGLISH summary Previously announced in IAA as A91-47764 (For primary document see N92-20589 11-61)
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Test and validation facilities for the software carried aboard the SPOT 4 satellite are described. Onboard software tests and validation and qualification of the satellite control center are outlined. The need for these test facilities to be coherent with the test philosophy used throughout the development program is stressed. On the SPOT 4 satellite, the software validation facility is designed according to a generic kernel used in the Electrical Ground Support Equipment (EGSE) platform. The general software and system test philosophy is outlined. ESA

N92-20603 Laboratori Elettronici e Nucleari, Milan (Italy).
CHECKOUT SOFTWARE ARCHITECTURES FOR INTEGRATION AND VERIFICATION OF SPACE SATELLITE
M. Poletti, D. Ravasi, and P. Chiroli *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 185-196 Previously announced in IAA as A91-47765 (For primary document see N92-20589 11-61)
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A checkout software architecture suitable to support integration and verification activities of complex space systems is described. Experiences along the growth process from simple to complex ground support equipment over several years of work are summarized. The availability of new products in CASE technology, machine interfaces, data base management systems and local area networks, allows for a new flexible modular architecture in which the role of software is increasingly important. The experience gained in developing complex Electrical Ground Support Equipment (ESE) such as that used for IRIS, TSS and SAX checkout demonstrated a continuous evolution toward the above approach derived from the approach adopted in the Giotto program. One of the most demanding requirements arising from the complex architectures is the need for flexibility in the checkout process. This can be accomplished through reconfiguration capability of the EGSE. The reconfiguration must be transparent to the test operator allowing reuse of the space modules at several test levels with different test system configuration. ESA

N92-20604 European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).
THE ESA SOFTWARE ENGINEERING STANDARDS: THEIR APPLICATION TO ESA SOFTWARE PROJECTS AND THEIR EVOLUTION
C. Mazza *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 199-203 Previously announced in IAA as A91-47766 (For primary document see N92-20589 11-61)
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The essential aspects of ESA standards and foreseen modifications are described. Practical application of the standards to ESA software projects is discussed. Benefits and problems encountered inside ESA and in industry involved in ESA projects are emphasized. Software engineering standards which are to be applied to all software developed for the agency by external companies or by internal teams are described. The initial set was reviewed after three years of use and was replaced in 1987 by the current standard (ESA-PSS-05-0, Issue 1). It is now being applied for any type of software and covers all the phases of the lifecycle. The lifecycle model can be considered a variant of a waterfall model allowing for iterations between the various phases and prototyping activities. The standards are classified, according to the IEEE practice for software engineering standards, into three categories; mandatory standards, recommended practices and guidelines. New revision of the standards is described. ESA

N92-20605 Marcol Computer Systems Ltd., Darmstadt (Germany, F.R.). Space Div.
ERS-1 MMCC EXPERIENCE: NOTES FOR FUTURE DEVELOPERS
W. W. Black and P. S. Soerensen (European Space Agency. European Space Operations Center, Darmstadt, Germany, F.R.) *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 205-214 Previously announced in IAA as A91-47767 (For primary document see N92-20589 11-61)
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ERS-1 Mission Management and Control Center (MMCC) software development is reviewed. The MMCC forms the central part of a highly distributed system. As a result of the experiences gained on this project, a number of important facets of project management and software engineering approach, involved in the project are described. The experiences gained in the project are predicted to prove useful as input for future ESA medium and large scale software development programs. ESA

N92-20606 Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.).
MANAGEMENT OF SOFTWARE DEVELOPMENT FROM MULTIPLE SOURCES (EXPERIENCES GAINED FROM THE ERS-1 PROGRAM)
Franz Sasse *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 215-226 Previously announced in IAA as A91-47768 (For primary document see N92-20589 11-61)
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Management aspects experienced during the development of the onboard software for the European Remote Sensing (ERS-1) satellite are described. The complete software lifecycle is considered starting from the design phase, passing over to the development-running phase and ending in the maintenance phase. Special emphasis is laid on the difficulties and constraints that show up during the different software life cycle phases and which

are mainly caused by the individual approach of software development applied to each part of the ERS-1 on board software. Based on the experiences, difficulties and constraints an evaluation is performed in view of advantages and disadvantages of the selected individual approach for the software development. A short outlook on future projects is given in which the common software development approach is discussed. This approach is planned to be applied for the Columbus and Hermes programs. The common approach is compared with the individual ERS-1 approach. ESA

N92-20607 Dornier System G.m.b.H., Friedrichshafen (Germany, F.R.).
IMPROVEMENTS NEEDED FOR SOFTWARE DEVELOPMENT IN THE LARGE
Bernd Koesters and Rainer Gerlich *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 227-240 Previously announced in IAA as A91-47769 (For primary document see N92-20589 11-61)
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The management of large software projects is discussed. Project management is terms of allocated man power, costs and time schedule is discussed. Management of contractors in view of the right definition and distribution of work packages, is considered. Software engineering aspects in terms of proper implementation, verification and validation of the software system, are reviewed. Use and operational aspects in view of definition of the desired system are considered. Maintenance aspects in view of building a (software) system which is easily maintainable over a long life time are considered. Software systems mostly represent a new functionality and their implementation is of high risk. In view of this the software manager has to provide a concept which allows to manage this risk and to deliver a result accepted by the user. ESA

N92-20608 Centre National d'Etudes Spatiales, Toulouse (France).
THE HIPPARCOS DATA REDUCTION ORGANIZATION [ORGANISATION DE LA REDUCTION DES DONNEES DU PROJET HIPPARCOS]
Jean-Louis Pieplu and Claude Huc *In its* The Management of Large Software Projects in the Space Industry Jun. 1991 p 241-251 In FRENCH Previously announced in IAA as A91-47770 (For primary document see N92-20589 11-61)
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The steps followed by the FAST (Fundamental Astronomy by Space Techniques) consortium in developing a data processing system are outlined. Experience gained in Hipparcos astrometric research is summarized. The research and development of the system was divided between several different European research institutes; the organizational and standardization measures taken in combining their efforts are outlined. The originality of the FAST data reduction system lies in its ability to allow for coexistence between the different management and command software of the different research institutes. Ways in which the coherence of management and command software systems are ensured are outlined. ESA

N92-20609 Centre National d'Etudes Spatiales, Toulouse (France).
RESEARCH AND DEVELOPMENT OF THE UARS-WINDII SCIENTIFIC PROJECT [LA REALISATION DU PROJET SCIENTIFIQUE UARS-WINDII] **c47**
Francoise Girod *In its* The Management of Large Software Projects in the Space Industry Jun. 1991 p 253-262 In FRENCH Previously announced in IAA as A91-47771 (For primary document see N92-20589 11-61)
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The software development management scheme for data processing of data from the WIND Imager Interferometer (WINDII) package carried aboard the Upper Atmosphere Research Satellite (UARS), is described. The scientific objectives of the UARS mission are outlined. The ground segment aspects of the UARS mission are described. The software specifications defined by NASA are summarized. The characteristics of the scientific software and the validation of the software are described. ESA

N92-20610 Aeritalia S.p.A., Turin (Italy). Space Systems Group.
SOFTWARE MANAGEMENT STRATEGIES AND PRACTICES FOR SPACE SYSTEMS DEVELOPMENT
Lorenzo Sarlo *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 263-270 Previously announced in IAA as A91-47772 (For primary document see N92-20589 11-61)
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Planning, coordination and control of the design and development of the software systems supporting the onboard and ground operations of a space system are discussed. Software management strategies, policies and practices are reviewed. The strategies act horizontally within the committing industrial organization and vertically down the subcontractor tree. The strategies are implemented through program level policies for software development. The ultimate objectives of the management effort are to assure that the deliverable software meet technical and programmatic requirements. Issues related to the insertion of new technologies as well as the transfer process from the development organization to flight operations are considered. Software management from the start of the system life cycle is discussed. Work breakdown and software industrial structures are discussed. Software management, engineering, and verification organizations are defined. Relationships between the software and other system disciplines are reviewed. Assessment of which standards shall be used is presented. The perspective taken is mainly oriented to the design and development of large software systems for space manned laboratories and related ground centers. Lessons learnt so far on the Columbus Attached Laboratory flight and ground infrastructures program and studies are reported. ESA

N92-20611 Compagnia Italiana Servizi Tecnici, Rome.
STANDARDS AND S/W DEVELOPMENT ENVIRONMENTS; THE POINT OF VIEW OF A S/W ENGINEERING COMPANY INVOLVED IN SEVERAL SPACE PROGRAMS **c04**
E. Ancillotto and R. Berni *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 271-279 Previously announced in IAA as A91-47773 (For primary document see N92-20589 11-61)
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Company capabilities involving integrated logistic support for air traffic control and navigation facilities, telecommunication systems, and satellite control centers and related ground infrastructures, are summarized. Software engineering for real time command and control, information management systems, remote sensing and image processing, and the system engineering services are summarized. The wide variety of standards and tools to be faced when involved with different projects and several customers is described. ESA

N92-20612 Computer Resources International A/S (Denmark).
MANAGEMENT IN SDE-BASED ORGANISATIONS **c81**
J. Langeland-Knudsen and J. Guldberg *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 281-286 Previously announced in IAA as A91-47774 (For primary document see N92-20589 11-61)
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The management of Software Development Environment (SDE) based organizations is discussed. Issues expected to be substantially influenced by the use of comprehensive engineering environments are addressed. These include the introduction of computer based tools leading to increased specialization in other engineering activities; project planning and tool investment tradeoffs

as likely to modify the financial structure of software engineering project. Conclusions are that the introduction of tools will change the economic conditions of software productions in the direction of spending more on investments, less on pure manpower costs; the complexity of the process of producing software will be moved to management of the design process (requirement specification, architectural design) and towards the test and validation process, but will also ease the management of subcontracting within large international projects. ESA

N92-20613 Aeritalia S.p.A., Turin (Italy).
IMPLEMENTING A CORPORATE SOFTWARE DEVELOPMENT METHODOLOGY
Sabino Cacucci and Glen Hosack *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 287-295 Previously announced in IAA as A91-47775 Prepared in cooperation with Computer Sciences Corp., Calverton, MD (For primary document see N92-20589 11-61)
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The selection, by a corporation, of a software development methodology has wide ranging implications not only to the firm but to the organizations relying on the resulting products. In the aerospace environment the implications are even more important, given the application criticality and complexity of the software. The corporate software development methodology must be flexible enough to incorporate tools and standards that are either required or appropriate to the development task. Yet, it must be structured enough to ensure disciplined development environment. The software development methodology selection process at Space Software Italia is described. The selection occurred at the inception of the company and thus allowed the implementation to permeate all aspects of the organization. The formation of this specialized organization, the software development methodology that was selected, and specific examples of how it has influenced the firm's operations are discussed. ESA

N92-20614 Space Engineering Europe, Brussels (Belgium).
SOFTWARE LIFECYCLE FROM AN OPERATIONS VIEWPOINT
D. Taylor *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 297-312 Previously announced in IAA as A91-47776 (For primary document see N92-20589 11-61)
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The criteria for success in any software project are to contain the project within the planned budget and timescale and to deliver software products which meet the operational (user) requirements. The close control of requirements at every level throughout the software lifecycle, from the initial development phase to the operations and maintenance phase, not only streamlines the development process, but is cost effective, ensuring that each contractor has an adequate specification. The tool to provide this control is effective management, geared to a logical hierarchical breakdown of major software functions which can in turn guide the management structure, the contractual hierarchy, and the scope of the subcontracts. It is demonstrated that the software lifecycle for large space projects can be approached from an operations viewpoint, where the breakdown of software functions is related to the operations tasks required to support the missions. This leads to partitioning and prioritization of software, and to the concept of reusability where the effective management and coordination of reusability can promote a more controlled and cost effective approach to the complete software system. ESA

N92-20615 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
SIMULATION AND CONTROL OF LARGE SOFTWARE PROJECTS [SIMULATION ET MAITRISE DES GRANDS PROJETS LOGICIELS]
Dominique Meyer *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 313-323 In FRENCH Previously announced in IAA as A91-47777 (For primary document see N92-20589 11-61)
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The growing complexity of space and aeronautical software systems has created a need for control of the software development process from the inception to the completion stages of the process. Software tools of two main types used in such a total control system are described. One group of tools is made up of formalization tools based on data processing processes such as functional analysis, specification and management. The other tools used are verification and validation tools, based on simulation techniques. Experiences in applying these software tools are described. ESA

N92-20616 CAE Electronics Ltd., Saint Laurent (Quebec).
A REAL-TIME Ada ENVIRONMENT THAT SIMPLIFIES MANAGEMENT AND REDUCES COST
A. Royle, T. Skeie, S. Ahn, S. Axelrad, and G. Langlois *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 325-333 Previously announced in IAA as A91-47778 (For primary document see N92-20589 11-61)
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A software environment and methodology that disciplines the use of a programming language and database structure to a particular application is described. The method ensures that all programmers produce a consistent, readable and efficient code. Such standardization enables less experienced staff to integrate quickly into the team and produce effectively with a minimum of supervision. A software environment methodology and tool set that simplifies management and can reduce the cost of large real time Ada software projects is described. ESA

N92-20617* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
LESSONS LEARNED IN THE DEVELOPMENT OF THE HUBBLE SPACE TELESCOPE SOFTWARE **c89**
Michael Harrington, Frank VanLandingham, and William C. Schneider (Computer Sciences Corp., Calverton, MD.) *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 335-343 Previously announced in IAA as A91-47779 Prepared in cooperation with Aeritalia S.p.A., Turin, Italy (For primary document see N92-20589 11-61)
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The lessons learned in the development of the Hubble Space Telescope software are described. Those aspects of the development that were successful are discussed. Areas which in retrospective analysis could have been more efficient are identified. It is concluded that few hardware oriented project managers understand or are comfortable with software technology. Most managers overestimate the size and magnitude of the complex tasks assigned. ESA

N92-20618 Societe d'Etudes des Systemes d'Automation, Toulouse (France).
DARWIN: AN EVOLUTIVE METHOD FOR SOFTWARE OBJECT ORIENTED ANALYSIS AND DESIGN
K. VuTien and D. Figarol (Centre d'Etudes de la Navigation Aerienne, Toulouse, France) *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 345-356 Previously announced in IAA as A91-47780 (For primary document see N92-20589 11-61)
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An extension of an existing structure software object oriented analysis and design method is described. The method, Differential Analysis, using Reusability Workstyles and Increment Nodes (DARWIN), recommends analysis of a system through evolutive mutations of its components. The extension described concentrates on the evolution of the software produced for a same application, and its reusability for other applications. The availability of

inheritance in modern programming languages makes this approach possible. ESA

N92-20619 INTECS Toscana S.R.L., Pisa (Italy). Research and Development Dept.
A PROPOSAL FOR USING FORMAL SPECIFICATIONS WITHIN THE HOOD METHOD
P. L. Iachini, A. Martelli, and F. Gallo *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 357-374 Previously announced in IAA as A91-47781 (For primary document see N92-20589 11-61)
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The proposal of a way to integrate a formal specification technique with an object oriented design methodology is addressed. In particular, the model oriented formal specification languages (like VDM, Z, etc.) and the object oriented design method HOOD, are considered. Putting formal specifications in the HOOD design process produces a two fold benefit. On the one hand, a class of problems which is peculiar to formal specifications is compensated by the structuring principles of HOOD. On the other hand, it is possible to formally describe the functional behavior of HOOD objects by means of the adopted specification language. This allows the rigorous verification of a large set of properties of the objects. This verification is not possible with the Ada pseudocode description used so far. ESA

N92-20620 Veridatas (France).
QUALITY CONTROL AND SOFTWARE ENGINEERING [ASSURANCE QUALITE ET GENIE LOGICIEL]
Francois deNazelle *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 377-382 In FRENCH Previously announced in IAA as A91-47782 (For primary document see N92-20589 11-61)
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The objectives of any manager of a data processing application are summarized. The objectives include adapting the data processing system to the needs of the users, and to the levels of quality and reliability specified. Meeting delivery dates and price estimates are other objectives of project managers. The reasons why these objectives are so often not met are outlined. Ways in which a manager can avoid the most common sources of error are identified. ESA

N92-20621 TECHLOG (France).
AGILE: AN EXPERT SYSTEM FOR LARGE SPACE PROJECT MANAGEMENT [AGILE, UN SYSTEME EXPERT D'AIDE A L'EXPLOITATION DES GRANDS PROJETS SPATIAUX] **c81**
Patrick Lesueur, Elisabeth Lautier, and Bernard Romeo (Centre National d'Etudes Spatiales, Toulouse, France) *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 383-390 In FRENCH Previously announced in IAA as A91-47783 (For primary document see N92-20589 11-61)
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Management systems for space project software are discussed. The memorizing, ordering, generating and ensuring aspects of software management are considered. Ways in which to approach the problem of choosing an expert system are outlined. The applicability of the AGILE expert system to typical management situations is demonstrated. The diagnostic aid aspects of the AGILE system seems to be the one most called upon by the users. Use of the system as a memory aid for the various specifications of a space project is seen as another much used aspect of the system. ESA

N92-20622 Aerospatiale, Les Mureaux (France). Div. des Systemes Strategiques et Spatiaux.
LARGE SYSTEM CONTROL BY CENTRALIZATION OF OPERATIONAL DATA [MAITRISE D'UN GRAND SYSTEME PAR CENTRALISATION DES DONNEES OPERATIONELLES] **c81**
Bernard Guichoux *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 391-394 In FRENCH Previously announced in IAA as A91-47784 (For primary document see N92-20589 11-61)
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The need for coherent and reliable operational data in a project, such as that of Ariane 5 launcher development, is stressed. To control the production cycles, of the different launcher stages and for launching and inflight control, coherent and reliable operational data must be readily available. An operational data base is proposed as a means of meeting the challenge. The data base to be used throughout the development and production stages is described. ESA

N92-20623 Aeritalia S.p.A., Turin (Italy). Space Systems Group.
COLUMBUS SOFTWARE: TRANSITION FROM SOFTWARE DEVELOPMENT TO SYSTEM OPERATIONS
Vittorio Ciampolini, David R. Harris, Nicholas Innes, and Carlo Paccagnini *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 395-403 Previously announced in IAA as A91-47785 (For primary document see N92-20589 11-61)
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An approach to the Columbus Attached Laboratory, focusing on the integrated use of the software development environment, software and system verification facilities and mission preparation tools, is presented. The following issues are particularly addressed: transfer of software from the subcontractor development and testing facilities to the system integration authority; integration of the software components into the system mission database; generation of the onboard software 'objects' to support system test campaigns; and generation of the onboard software 'objects' for a given system mission. The scenarios of involvement of the Attached Laboratory Engineering Support Center in software maintenance during Space Station Freedeom flight operations are presented. ESA

N92-20624 MATRA Espace, Toulouse (France).
GROUND SYSTEM SOFTWARE MAINTENANCE [MAINTENANCE DES LOGICIELS DES SYSTEMES SOL]
Jean-Louis Ducuing, Jean-Paul Denier, Olivier Pasero, and Amaury Simon (Durham Univ., England) *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 405-417 In FRENCH Previously announced in IAA as A91-47786 (For primary document see N92-20589 11-61)
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The need for new flight system software maintenance systems for future space projects such as Hermes and Columbus is stressed. A satellite control center with a lifespan of 10 years and a software volume of 180,000 operations is submitted to a number of performance tests. The problems encountered during these tests, and the solutions found to correct them are outlined. The needs of future systems are shown to demand a global rethinking of the space project requirements as early as the B phase of development and refined over the life of the system. ESA

N92-20625 European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).
A STRATEGY FOR DATA PROCESSING WITHIN THE GROUND SEGMENT OF ESA'S IN ORBIT INFRASTRUCTURE **c82**
M. Clendining *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 421-433 Previously announced in IAA as A91-47787 (For primary document see

N92-20589 11-61)
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ESA's In Orbit Infrastructrure (IOI) comprises the Hermes Spaceplane, the Columbus Attached Laboratory and Free Flying Laboratory, the Polar Platform, and the data relay system. The approach taken in identifying all IOI ground segment Data Processing (DP) requirements is described. Traceability of DP requirements to higher level documents is discussed. Development of an overall ground segment DP architecture is outlined. Allocation of DP subsystems to three categories: common, shared, and facility specific is described. Tailoring the DP architecture for individual facilities is discussed. Concepts for data and software security are considered. ESA

N92-20626 Logica Ltd., London (England).
WHY IS SPACE SOFTWARE SPECIAL?
P. Norris *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 435-441 Previously announced in IAA as A91-47788 (For primary document see N92-20589 11-61)
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Two of the implications of the uniqueness of space software are discussed: software development environments tailored for space software; and research to address the specific requirements of space software. Characteristics of onboard software are discussed including the space environment and constraints on onboard software. A discussion that these suggest that spaceborne software is different from other forms of software is given. ESA

N92-20627 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE ELECTRONIC COPILOT: A FRUITFUL EXPERIENCE TOWARD COMPLEX PROJECT MANAGEMENT USING ARTIFICIAL INTELLIGENCE IN THE SPACE DOMAIN c63
Yann Renault and Gilles Champigneux *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 443-462 Previously announced in IAA as A91-47789 (For primary document see N92-20589 11-61)
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Crew involvement in future European manned space mission with Hermes and Columbus is discussed. The effects of high workloads on astronauts in orbit are evaluated. Extensive mission support by a large group of skilled ground personnel is predicted. In order to maximize the mission efficiency and the cost effectiveness of space operations, good management of limited and valuable crew time is recommended. Good allocation of functions between astronauts and automatic systems, and an effective man-machine interface (MMI) design are presented. Automatic systems and robots which should eventually significantly reduce the astronauts workload are described. They are necessary for actions that require fast and highly accurate response, and for tedious and repetitive tasks. The role for humans in such a control loop is discussed. ESA

N92-20628 Aerospatiale, Les Mureaux (France). Groupe Logiciels des Systemes.
HERMES SIMULATION [SIMULATION HERMES] c16
M. Toussaint *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 463-477 In FRENCH Previously announced in IAA as A91-47790 (For primary document see N92-20589 11-61)
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The simulation programs used within the Hermes project, in order to validate systems and components, are outlined. The strategy chosen within the framework of the program to ensure the coherence of the means of simulation and diminish the overall cost while guaranteeing the validity of the system is outlined. Coherence of the subsystems is ensured by the architecture and specifications of the system. ESA

N92-20629 Societe Anonyme de Telecommunications, Toulouse (France).
DATA PROCESSING ASPECTS OF THE HERMES FLIGHT CONTROL CENTER [LES ASPECTS DATA PROCESSING DANS LE CENTRE DE CONTROLE EN VOL HERMES] c82
Francois Martin-Dupont *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 479-494 In FRENCH Previously announced in IAA as A91-47791 (For primary document see N92-20589 11-61)
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The overall content and goals of the Hermes project are reviewed. The specific data processing needs of each different section of the Hermes project are considered. Operational organization and preliminary architecture schemes are studied. Test strategy, validation, and qualification are discussed. Future applications of the approach to industrial organization and development planning are considered. ESA

N92-20642# National Inst. of Standards and Technology, Gaithersburg, MD.
PROCEEDINGS OF THE WORKSHOP ON HIGH INTEGRITY SOFTWARE Final Report
D. R. Wallace, D. R. Kuhn, and J. C. Cherniavsky Aug. 1991 11 p Workshop held in Gaithersburg, MD, 22-23 Jan. 1991
(PB92-109040; NIST/SP-500/190) Avail: NTIS HC/MF A03; also available SOD HC $5.50 as 003-003-03108-9 CSCL 09B

Information related to the National Institute of Standards and Technology (NIST) effort to coordinate an effort to produce a comprehensive set of standards and guidelines for the assurance of high integrity software is given. The effort may include adapting or adopting existing standards as appropriate. In particular, the results of a workshop on the Assurance of High Integrity Software held at NIST on January 22 and 23, 1991 are presented. Workshop participants addressed techniques, costs and benefits of assurance, controlled and encouraged practices, and hazard analysis. A preliminary set of recommendations was prepared and future directions for NIST activities in this area were proposed. Author

N92-20675# Utrecht State Univ. (Netherlands). Dept. of Computer Science.
MCSPARSE: A PARALLEL SPARSE UNSYMMETRIC LINEAR SYSTEM SOLVER
K. A. Gallivan, B. A. Marsolf (Illinois Univ., Urbana.), and H. A. G. Wijshoff Sep. 1991 67 p Sponsored in part by CSRD Affiliates Program
(Contract DE-FG02-85ER-25001; NSF CCR-87-17942; NSF MIP-84-10110)
(RUU-CS-91-36; ISSN-0924-3275; ETN-92-91102) Avail: NTIS HC/MF A04

An unsymmetric sparse linear system solver based on the exploitation of multilevel parallelism is proposed. One of the main issues addressed is the application of tearing techniques to enhance large-grain parallelism in a manner that maintains reasonable stability. This is accomplished by a combination of a novel reordering technique (hybrid ordering) and pivoting strategy. The large-grain parallelism exposed by the reordering is combined with medium (various parallel row updates strategies) and fine-grain (vectorization) parallelism to allow adaptation to a wide range of multiprocessor architectures. Experimental results are presented which show the effectiveness of the reordering, as well as the stability and efficiency of the solver. ESA

N92-20710# Naval Ocean Systems Center, San Diego, CA.
MICROCIM COMPUTER INTEGRATED MANUFACTURING IN THE HYBRID MICROELECTRONICS INDUSTRY
T. J. Sampite Dec. 1991 12 p
(AD-A244875) Avail: NTIS HC/MF A03 CSCL 13/8

The MicroCIM program is managed by the Manufacturing Technology Branch at NOSC under sponsorship of the Director, Navy MANTECH Program, Office of the Assistant Secretary of the Navy for Research, Development, and Acquisition. Funding is provided from the Navy Industrial Preparedness budget which has

the purpose of assisting American industry to be economically competitive with foreign suppliers and therefore sufficiently capable of meeting the needs of the United States Navy during any emergent situation. The intent is to develop new or improved processes, methods, techniques, or equipment to enhance industrial base capability. While this has focused on cost benefits, quality is also seen as an important value. MicroCIM is an outgrowth of the Integrated Facility for Automated Hybrid Microcircuit manufacturing (IFAHMM). The purpose of IFAHMM was to develop a test facility to evaluate state-of-the-art technology for the manufacture of hybrid microcircuits. This technology could be used to enhance production capability and, as a result, produce parts at a lower cost to the DoD. GRA

N92-20792# Sheffield Univ. (England). Dept. of Automatic Control and Systems Engineering.
IDENTIFICATION OF MULTI-CLASS LINEAR AND NONLINEAR SYSTEMS
K. M. Tsang (Hong Kong Polytechnic, Kowloon.) and S. A. Billings May 1991 43 p
(RR-431; ETN-92-90654) Avail: NTIS HC/MF A03

An algorithm for the identification of multiclass systems which can be described by a class of models over different operating regions is presented. The algorithm involves partitioning the raw data set using discriminant functions followed by parameter estimation. An orthogonal least squares algorithm and a backward elimination procedure are employed for parameter estimation and data partitioning processes. Provided that the data elements are linearly separable, the proposed algorithm will correctly partition the data into the respective classes, and parameter estimation algorithms can then be applied to estimate the models associated with each different class. ESA

N92-20809# Applied Research Lab., Virginia Beach, VA.
CAE TOOLS ASSESSMENT FOR TPS DEVELOPMENT (PRELIMINARY)
David Gordon 26 Feb. 1991 31 p
(Contract N00189-90-C-0437)
(AD-A244633) Avail: NTIS HC/MF A03 CSCL 12/5

This report discusses the application of Computer Aided Engineering (CAE) tools to the Test Program Set (TPS) development process, the selection of CAE tools for TPS development, and evaluation recommendations for CAE tools. Electronic design application tools were considered to establish a methodology for TPS development and provide a total computer based TPS development environment. These requirements dictate a highly integrated set of CAE tools which are targeted toward specific TPS development problems. The test strategy generation, testing requirements, reverse engineering, and Interface Device development are the specific TPS development problems investigated. The study will encompass a preliminary report (this report), an interim report and the final report. The preliminary study selected the Cadence design environment for evaluation on the SUN workstation because of the open CAE software operating environment considerations, circuit representation capabilities and integration with the SABER analog simulation tool. GRA

N92-20832 Tel-Aviv Univ. (Israel). Dept. of Computer Science.
MPE: A PARALLEL PROGRAMMING ENVIRONMENT FOR A DISTRIBUTED MEMORY MULTICOMPUTER M.S. Thesis
Roy Laor Sep. 1990 72 p
(ITN-92-85154) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

Distributed memory multicomputers offer high levels of performance and flexibility, but have proven awkward to program. MPE (Multicomputer Programming Environment) is a software package that provides a high level parallel programming environment for a non-shared memory multicomputer called MOSIX. The approach chosen in MPE is programming in standard and common languages like FORTRAN and C, with several extensions, while keeping the principle of high level programming, i.e., avoiding the need to deal with details like sending/receiving messages, handling processes, etc. The programmer still has to think 'parallelly' and break his algorithm into parallel parts. However, the approach used by MPE gives him some major benefits: a relatively simple transformation of existing sequential applications into parallel ones, the ability to write parallel programs in conventional (popular) languages, simple debugging, and independence of the hardware configuration. Based on the master/slaves model, the main tool which MPE gives the programmer is an asynchronous remote procedure call. This call enables the programmer to distribute the computation among the processors in the system while synchronization and load balancing are being handled by MPE and MOSIX kernel. The MPE package includes a precompiler and a runtime library. It is written in the C language and uses standard UNIX SYS V system calls; thus, it may be ported to any UNIX multiprocessor system easily. Several examples of transforming fundamental sequential algorithms into parallel version using MPE are demonstrated as well as some performance measurement results. Author (ISA)

N92-20869# Delta Information Systems, Inc., Horsham, PA.
STANDARD BI-LEVEL IMAGES Final Report
May 1991 61 p
(Contract DCA100-83-C-0047)
(AD-A244961; NCS-TIB-90-17) Avail: NTIS HC/MF A04 CSCL 25/3

The purpose of this project was to generate a new set of standard images that can be used by experimenters developing bi-level compression algorithms. The NCS sponsored the scanning of documents used by the International Telegraph and Telephone Consultative Committee (CCITT) at resolutions of 200, 240, 300, 400 and 480 lines per inch and stored the resultant data on tape. This data has been used by many experimenters in the development of standard compression algorithms for digital facsimile. This work contributed significantly to the development of high resolution facsimile standards which will be of considerable value to the U.S. Government. The purpose of compiling a standard set of bi-level images is to make the results presented by various experimenters in the field directly comparable, without regard to differences in image content. As a result of this project, all experiments engaged in performing studies for the CCITT regarding bi-level transmission techniques will have access to magnetic tapes or DOS diskettes containing digitized versions of the standard images. In addition, the images will be useful in evaluating graphic printer quality and capability. GRA

N92-20905 Tel-Aviv Univ. (Israel). Dept. of Computer Science.
TIMING ANALYSIS OF PARALLEL ALGORITHMS ON A MIMD MULTIPROCESSOR M.S. Thesis
Barack Shoham Feb. 1990 45 p
(ITN-92-85153) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

Two parallel processing applications were implemented on a shared memory MIMD (Multiple Instruction Multiple Data Stream) machine. In studying the speedup achievable through using multiple processors to solve CFD (charge flow device) problems, especially the computation of aerodynamic flow around complex bodies, a finite difference solution of a 2-D boundary problem was considered, with appropriate domain partition. The implementation of single grid and multigrid solutions on shared memory and shared bus (nonvector) MIMD multiprocessors was examined. When each processor was assigned a single horizontal line, processing time of the single grid solution increased nearly linearly with the number of grid points in the slice; the dependence was nonlinear for the multigrid solution, owing to the change in the number of processors utilized in different levels of the scheme. The second application involved the speedup achievable through using multiprocessors for solving Toeplitz systems, using a modified Levinson algorithm related to signal processing and very large scale integration. Local processing was used in this application, to facilitate parallel computing. When each processor was assigned a single entry in the solution vector, the processing time increased nonlinearly with the size of the matrix, owing to the global data transmission. Both applications were implemented on an MIMD machine, using the

MMX (Multiprocessor Multitasking eXecutive), which is an experimental shared memory multiprocessor operating system.
ISA

N92-20942# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
FUNCTIONAL DESCRIPTION OF MINTO, A MIXED INTEGER OPTIMIZER
Martin W. P. Savelsbergh, Gabriele C. Sigismondi, and George L. Nemhauser (Georgia Inst. of Tech., Atlanta.) Aug. 1991 55 p (Grants NATO-62-316.89; NSF ISI-87-61183; NATO-CRG-901057) (Memo-COSOR-91-17; ISSN-0926-4493; ETN-92-91135) Avail: NTIS HC/MF A04

MINTO (Mixed INTeger Optimizer) is a software system that solves mixed integer linear programs by a branch and bound algorithm with linear programming relaxations. It also provides automatic constraint classification, preprocessing, primal heuristics and constraint generation. Moreover, the user can enrich the basic algorithm by providing a variety of specialized application routines that can customize MINTO to achieve maximum efficiency for a problem class. MINTO is documented by specifying what it is capable of doing and how to use it. ESA

N92-20945# Martec Ltd., Halifax (Nova Scotia).
MODIFICATIONS TO THE PATRAN TRANSLATOR PROGRAMS VASPAT AND PATVAS
M. F. Palmeter and M. W. Chernuka Aug. 1990 158 p Sponsored by Defence Research Establishment Atlantic
(DREA-CR-90-454; CTN-92-60440) Avail: NTIS HC/MF A08

The PATVAS and VASPAT computer programs have been upgraded. These programs represent the forward and inverse translator programs which interface the general purpose modeling program PATRAN with the linear finite element analysis program VAST. The upgrades include the development of a capability to translate boundary conditions and skewed coordinate data. Load data translation has been improved not only with respect to edge loads for the thick/thin shell element but also with the extension of dynamic load option to periodic load specification. The generalized algorithms to permit translation of degenerate forms of the 20-noded solid element have also been provided. A framework has been established for automatic translation of finite element models between VAST and alternate programs such as ADINA. Different methods for specification of physical property data are identified and demonstrated for the case of a stiffened plate. Author (CISTI)

N92-20952# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
SORTING WITH A NEURAL NET
P. J. Zwietering, E. H. L. Aarts (Philips Gloeilampenfabrieken N.V., Eindhoven, Netherlands), and J. Wessels May 1991 20 p (Memo-COSOR-91-10; ISSN-0926-4493; ETN-92-91130) Avail: NTIS HC/MF A03

A three-layered perceptron is derived that exactly solves the problem of sorting n numbers. The perceptron configuration has O(n(exp 2)) nodes and can be viewed as a neural implementation of the parallel enumerative sorting algorithm developed by Preparata. Furthermore, it is shown that the problem of sorting n numbers cannot be solved exactly by a two-layered perceptron.
ESA

N92-20959# Lawrence Livermore National Lab., CA.
BEYOND PRELIMINARY ANALYSIS OF THE WANK AND OILZ WORMS: A CASE STUDY OF MALICIOUS CODE
T. A. Longstaff and E. E. Schultz 11 Oct. 1991 25 p Presented at the 3rd Workshop on Computer Security Incident Handling, Herndon, VA, 6-8 Aug. 1991
(Contract W-7405-eng-48)
(DE92-007326; UCRL-JC-108518; CONF-9108194-2) Avail: NTIS HC/MF A03

In October 1989, a DECnet worm attacked the NASA Space Physics Analysis Network (SPAN) and the DOE's High Energy Physics (HEP) and Energy Science (ES) Networks. Approximately two weeks later a second worm, a modification of the first, attacked additional systems. These worms (written in DCL) used several methods of propagation, including guessing accounts with an identical username and password and entering through system accounts and unpassworded accounts. The original version of the worm, WANK (Worms Against Nuclear Killers), contained bugs preventing, among other things, penetration into unpassworded accounts. In the second version, OILZ, some of the problems of the first worm were corrected. OILZ intruded into user accounts probed from remote systems already breeched by this worm. OILZ masqueraded its presence and its method of discovering user accounts and privileged access helped circumvent standard VMS alarm settings. The style of each worm code indicated that the worm evolved over time and was not written by a single individual. This paper focuses on selected procedures from both variations of the worm and analyzes the authorship and history of the development of this worm. This information may be useful not only in determining the origin of this malicious code, but also in studying the evolution of malicious code. This paper also presents some lessons learned from studying this attack and applies these lessons to recommendations for network policy. More than anything else, the WANK and OILZ worms demonstrate the need for effective password management and proper system and network configuration. Determining the source and style of malicious code can assist in developing policies and procedures for effectively detecting and preventing attacks of this type. DOE

N92-20994# Naval Postgraduate School, Monterey, CA.
DECISION MAKING FOR SOFTWARE PROJECT MANAGEMENT IN A MULTI-PROJECT ENVIRONMENT: AN EXPERIMENTAL INVESTIGATION M.S. Thesis
Michael J. Hardebeck Sep. 1991 119 p
(AD-A245063) Avail: NTIS HC/MF A06 CSCL 12/5

Software project development can be characterized as failing to meet the user's needs within budget and schedule limitations. The number of software development failures far exceeds the number delivered as specified throughout industry and specifically in the Department of Defense. The System Dynamics Model of Software Project Management is a sustained and generally accepted quantitative model for simulating the software development lifecycle. Dynamic management issues can now be evaluated in an experimental setting which eliminates the financial risks. The objective is to use the System Dynamics Model's gaming interface to investigate the effects of managerial motivation on software project managers in a multiproject environment. Specifically, this experiment was conducted to determine the effect of individual or team motivation on subsystem managers of a larger project. The effect of the two motivation methods is measured in terms of staffing level decisions, final cost, and final duration. GRA

N92-21032# Fermi National Accelerator Lab., Batavia, IL.
SOFTWARE DEVELOPMENT FOR A SWITCH-BASED DATA ACQUISITION SYSTEM
A. Booth (Superconducting Super Collider Lab., Dallas, TX.), D. Black, and D. Walsh Dec. 1991 7 p Presented at the IEEE Nuclear Science Symposium, Santa Fe, NM, 5-9 Nov. 1991
(Contract DE-AC02-76CH-03000)
(DE92-007516; FNAL/C-91/337; CONF-911106-79) Avail: NTIS HC/MF A02

We report on the software aspects of the development of a switch-based data acquisition system at Fermilab. This paper describes how, with the goal of providing an integrated systems engineering environment, several powerful software tools were put in place to facilitate extensive exploration of all aspects of the design. These tools include a simulation package, graphics package, and an expert system shell which have been integrated to provide an environment which encourages the close interaction of hardware and software engineers. This paper includes a description of the simulation, user interface, embedded software, remote procedure calls, and diagnostic software which together have enabled us to provide real-time control and monitoring of a

working prototype switch-based data acquisition (DAQ) system.
DOE

N92-21059# Argonne National Lab., IL. Environmental Assessment and Information Sciences Div.
APPLICATION INTERFACE ENGINE APPLICATION DEVELOPER'S MANUAL
M. A. Widing, R. S. Fuja, R. A. Hoffer, M. K. Duffy, and C. E. Swietlik Jul. 1991 109 p
(Contract W-31-109-eng-38)
(DE92-003659; ANL/EAIS/TM-61) Avail: NTIS HC/MF A06

The Application Interface Engine (AIE) is a software tool that provides an environment for application development. The AIE system facilitates the development of graphical database applications. By using the AIE, a developer can isolate the various components of an application to provide portability and maintainability. The control structure of the application is written in a special object-oriented language that is provided with the system. The language contains objects that abstract the different application components. High-level objects are defined for implementing details of the user interface, database access, and process communication. After the AIE language is used to specify the application control, the program is converted to C code and linked to the AIE libraries. The application's user interface uses the User Interface Manager library to interact with an X Window environment. Data in files or in an Ingres database can be accessed through the Data Object Manager Library. Processes written in traditional languages, such as C or Ada, can be used through the External Function Handler Library. The current version of the AIE operates on a Sun 3 or 4 workstation. This manual documents the design and capabilities of the AIE and its use by a developer.
DOE

N92-20765# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.). Space Operations Center.
SOFTWARE FOR STATION KEEPING OF CO-LOCATED GEOSTATIONARY SATELLITES
Alfred Pietrass, M. C. Eckstein, and O. Montenbruck *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 329-335 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

N92-20766# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (Germany, F.R.). Space Operations Center.
THE DLR-GSOC LAUNCH WINDOW SOFTWARE
Reinhard Kiehling *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 337-342 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

62 COMPUTER SYSTEMS

Includes computer networks and special application computer systems.

N92-20078# Massachusetts Inst. of Tech., Cambridge. Lab. for Computer Science.
SCALABLE READER-WRITER LOCKS FOR PARALLEL SYSTEMS
Wilson C. Hsieh and William E. Weihl Nov. 1991 22 p
(Contract N00014-89-J-1988)
(AD-A243147; MIT/LCS/TR-521) Avail: NTIS HC/MF A03 CSCL 12/6

Current algorithms for reader writer synchronization exhibit poor scalability because they do not allow readers to acquire locks independently. We describe two new algorithms for reader-writer synchronization that allow parallelism among readers during lock acquisition. We achieve this parallelism by distributing the lock state among different processors, and by trading reader throughput for writer throughput; we expect that in highly concurrent programs, the ratio of writers to readers should be very low, so this tradeoff should lead to better overall performance. We used a multiprocessor simulator, Proteus, to compare these algorithms with existing algorithms. Our experiments show that when reads are a large percentage of lock requests, the throughput of both of our algorithms scales significantly better than current algorithms; even when there is a fair percentage of writes, the throughput of one of our algorithms still scales better than current algorithms.
GRA

N92-20167# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
MEAN VALUE APPROXIMATION FOR CLOSED QUEUING NETWORKS WITH MULTI SERVER STATIONS
I. Adan and A. Dekkers Aug. 1990 10 p Sponsored in part by Netherlands Organization of the Advancement of Scientific Research
(Memo-COSOR-90-31; ETN-92-91108) Avail: NTIS HC/MF A02

An approximate recursive relation for the sojourn time, queuelength and throughput of a multiserver station, embedded in a closed queueing network is formulated. Based on that relation, a mean value approximation is derived and a Schweitzer approximation for solving larger networks is formulated. Numerical examples show that the approximate mean value algorithm yields accurate results.
ESA

N92-20172# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
PERIODIC ASSIGNMENT AND GRAPH COLOURING
Jan Korst, Emile H. L. Aarts, Jan Karel Lenstra (Center for Mathematics and Computer Science, Amsterdam, Netherlands), and Jaap Wessels Jun. 1991 17 p
(Memo-COSOR-91-14; ISSN-0926-4493; ETN-92-91173) Avail: NTIS HC/MF A03

The problem of executing periodic operations on a minimum number of identical processors under different constraints is analyzed. The analysis is based on a reformulation of the problem in terms of graph coloring. It is shown that different constraints result in coloring problems that are defined on different classes of graphs, viz. interval graphs, circular arc graphs and periodic interval graphs. The coloring of such graphs is discussed.
ESA

N92-20471# Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
A PARALLEL METHOD FOR OPTIMAL ROUTING IN PACKET-SWITCHED NETWORKS Ph.D. Thesis - Inst. National des Sciences Appliquees
Cassilda Maria Ribeiro 1991 148 p In FRENCH; ENGLISH summary Sponsored by CAPES/MEC and ICMSC/USP
(LAAS-91340; ETN-92-90950) Avail: NTIS HC/MF A07

A parallel dual method for optimal routing in packet switched networks is presented. The basic notions of parallelism (models of parallelism, parallel architectures, languages) are reviewed. Classical results in unconstrained nonlinear programming and classical descent iteration methods are discussed. Optical routing in packet switched networks is studied. An original dual method for optical routing is presented. How to parallelize this method in order to implement it on the distributed memory multiprocessor, Tnode, is studied. Experimental results are presented and analyzed.
ESA

N92-20899# Naval Postgraduate School, Monterey, CA.
TCP/IP IMPLEMENTATION CONSIDERATIONS FOR ADMINISTRATIVE SCIENCES DEPARTMENT LOCAL AREA NETWORKS M.S. Thesis
Michael S. Hill Sep. 1991 56 p
(AD-A245081) Avail: NTIS HC/MF A04 CSCL 12/7

The ability to rapidly access and exchange information by Department of Defense activities is critical to successfully accomplishing their mission. At the Naval Postgraduate School in

Monterey, California, the need for connectivity with other organizations, such as research and other academic institutions is just as critical, with computer communications through the Internet providing this capability. This thesis discusses the issues surrounding providing Internet connectivity through implementation of TCP/IP software in a LAN setting. Especially emphasized are the unique circumstances faced by the Administrative Sciences Department LAN managers in using TCP/IP in an academic LAN environment. Options for TCP/IP implementation are discussed, along with what would comprise the optimum LAN TCP/IP configuration, given various constraints. GRA

N92-20941# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
A COMPENSATION PROCEDURE FOR MULTIPROGRAMMING QUEUES
I. J. B. J. Adan, G. J. vanHoutum, J. Wessels, and W. H. M. Zijm (Universiteit Twente, Enschede, Netherlands) May 1991 26 p (Memo-COSOR-91-13; ISSN-0926-4493; ETN-92-91132) Avail: NTIS HC/MF A03

A multiprogramming system consisting of an Input Output (IO) and a Central Processor (CP) is studied. This system can be represented by a continuous time Markov process with states (m,n), where m and n denote the number of jobs at the CP and the IO unit respectively. The computation of the equilibrium distribution (P(sub m,n)) of this Markov process is considered. The analysis consists of two parts. In the first part, a compensation procedure is used to show that the equilibrium distribution (P(sub m,n)) in those states (m,n) for which (m + n) is not too small, can be expressed as an infinite linear combination of product forms. Explicit formulae are given for the product forms and the coefficients of this infinite linear combination. In the second part of the analysis, attention is given to some numerical aspects of the computation of the equilibrium distribution. For the computation of the equilibrium probabilities that can be expressed as infinite linear combinations of product forms, bounds for the errors caused by cutting off these infinite linear combinations are derived, and numerically stable formulae to compute one by one the remaining equilibrium probabilities are presented. ESA

N92-21001# Argonne National Lab., IL. Mathematics and Computer Science Div.
ROO: A PARALLEL THEOREM PROVER
E. L. Lusk, W. W. McCune, and J. K. Slaney Nov. 1991 13 p (Contract W-31-109-eng-38)
(DE92-003232; ANL/MCS-TM-149) Avail: NTIS HC/MF A03

We describe a parallel theorem prover based on the Argonne theorem-proving system OTTER. The parallel system, called Roo, runs on shared-memory multiprocessors such as the Sequent Symmetry. We explain the parallel algorithm used and give performance results that demonstrate near-linear speedups on large problems. DOE

63 CYBERNETICS

Includes feedback and control theory, artificial intelligence, robotics and expert systems.

For related information see also *54 Man/System Technology and Life Support.*

N92-20154# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE DISSIPATION INEQUALITY AND THE ALGEBRAIC RICCATI EQUATION
H. L. Trentelman and J. C. Willems (Groningen Rijksuniv., Netherlands) 22 Nov. 1990 50 p
(Memo-COSOR-90-44; ETN-92-91119) Avail: NTIS HC/MF A03

An expository survey of the main concepts, results and applications related to the algebraic Riccati equation is given. The existing theory of dissipative systems is reviewed and extended starting with a treatment of dissipativeness for a very general class of systems. Contrary to most of the existing literature on dissipative systems, where the property of dissipativeness is described in terms of the internal (state space) properties of the system, dissipativeness is considered as a property of the external behavior of the system. It is shown that for linear, time invariant, finite dimensional systems with quadratic supply rates, the property of internal dissipativeness leads to solvability of the associated algebraic Riccati equation. Real symmetric solutions of the Riccati equation correspond to storage functions of the system. In this vein, it turns out that the Riccati equation has a positive semi-definite solution if and only if there exists a storage function that attains its minimum at the origin. How the question of existence of positive semi-definite solutions leads to the Kalman-Yakubovich-Popov lemma (sometimes called the positive real lemma) and the bounded real lemma is explained. ESA

N92-20182# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE SINGULAR MINIMUM ENTROPY H INFINITY CONTROL PROBLEM
A. A. Stoorvogel 8 Oct. 1990 20 p
(Memo-COSOR-90-37; ETN-92-91114) Avail: NTIS HC/MF A03

Controllers which minimize an entropy function of the closed loop transfer matrix under the constraint of internal stability and under the constraint that the closed loop transfer matrix has H infinity norm less than some a priori given bound gamma are searched for. An explicit expression for the infimum is found. Moreover, a characterization is given when the infimum is attained (contrary to the regular case, for the singular minimum entropy H infinity control problem the infimum is not always attained). ESA

N92-20236 Illinois Univ., Urbana-Champaign.
ADAPTIVE CONTROL OF FLEXIBLE JOINT ROBOT MANIPULATORS: A SINGULAR PERTURBATION APPROACH
Ph.D. Thesis
Fathi Ghorbel 1991 214 p
Avail: Univ. Microfilms Order No. DA9136599

The adaptive control of flexible joint robot manipulators using composite control is presented first. This slow/fast control strategy consists of a slow adaptive controller designed for a rigid robot together with a fast controller to damp the elastic oscillations of the joints. The mathematical details and rigorous stability proofs of this algorithm are presented. Using the composite Lyapunov theory for singularly perturbed systems, sufficient conditions for adaptive trajectory tracking are presented. A second approach based on the method of integral manifolds for singularly perturbed system is presented next. The known parameter case is treated and stability analysis is included. The method of integral manifolds is then extended to the adaptive case. Sufficient conditions for adaptive trajectory tracking are presented for both the general case and a special class of robot manipulators. Finally, experimental and simulation results are included to show different aspects of the results including adaptive instability mechanisms.
Dissert. Abstr.

N92-20275*# Alabama Univ., Huntsville. Dept. of Electrical and Computer Engineering.
FLEXIBLE BODY CONTROL USING NEURAL NETWORKS
Final Report, Jun. 1991 - Mar. 1992
Claire L. McCullough 5 Mar. 1992 32 p
(Contract NAS8-36955)
(NASA-CR-184294; NAS 1.26:184294; UAH-5-32687) Avail: NTIS HC/MF A03 CSCL 09B

Progress is reported on the control of Control Structures Interaction suitcase demonstrator (a flexible structure) using neural networks and fuzzy logic. It is concluded that while control by neural nets alone (i.e., allowing the net to design a controller with no human intervention) has yielded less than optimal results, the neural net trained to emulate the existing fuzzy logic controller does produce acceptible system responses for the initial conditions examined. Also, a neural net was found to be very successful in performing the emulation step necessary for the anticipatory fuzzy controller for the CSI suitcase demonstrator. The fuzzy neural

hybrid, which exhibits good robustness and noise rejection properties, shows promise as a controller for practical flexible systems, and should be further evaluated. Author

N92-20286 Pennsylvania State Univ., University Park.
ROBOTIC MANIPULATION USING A BEHAVIORAL FRAMEWORK Ph.D. Thesis
Sanjay Kumar Agrawal 1991 132 p
Avail: Univ. Microfilms Order No. DA9200306

A robotic manipulation system was built that is capable of functioning in an unstructured network. In order to provide such functionality, the system must be capable of reacting in a compliant manner to any stimuli in the environment at the motor level, and use the same information to modify its existing plan of action. To build a general enough system that can handle a wide range of manipulatory tasks, motion primitives were built both at the task level, termed motor programs, and at the motor level which is termed reflexes. Motor programs specify the behavior of the system at the motor level in terms of the desired stimuli response characteristic. Thus, the concept of behavior is introduced to represent the sensorimotor relationship that can be defined at different levels of detail. More complex behaviors are manifested by coordinating the behavior of a number of motor systems. Borrowing extensively from advances in the area of neurobiology and neuropsychology, the human motor system is mimicked by creating a hierarchial control system in which the motor programs are incorporated at the highest level. The behavioral robotic framework is used both on a graphics simulator as well as an experimental testbed. Dissert. Abstr.

N92-20517*# Maryland Univ. Baltimore County, Catonsville. Dept. of Mechanical Engineering.
ROBUST TUNING OF ROBOT CONTROL SYSTEMS Final Report, 1 May 1991 - 30 Apr. 1992
I. Minis and M. Uebel 1 Apr. 1992 129 p
(Grant NAG5-1550)
(NASA-CR-190131; NAS 1.26:190131) Avail: NTIS HC/MF A07 CSCL 09B

The computed torque control problem is examined for a robot arm with flexible, geared, joint drive systems which are typical in many industrial robots. The standard computed torque algorithm is not directly applicable to this class of manipulators because of the dynamics introduced by the joint drive system. The proposed approach to computed torque control combines a computed torque algorithm with torque controller at each joint. Three such control schemes are proposed. The first scheme uses the joint torque control system currently implemented on the robot arm and a novel form of the computed torque algorithm. The other two use the standard computed torque algorithm and a novel model following torque control system based on model following techniques. Standard tasks and performance indices are used to evaluate the performance of the controllers. Both numerical simulations and experiments are used in evaluation. The study shows that all three proposed systems lead to improved tracking performance over a conventional PD controller. Author

N92-20662*# Institute for Computer Applications in Science and Engineering, Hampton, VA.
CONVERGENCE OF CONTROLLERS DESIGNED USING STATE SPACE METHODS Final Report
K. A. Morris (Waterloo Univ., Ontario) Dec. 1991 21 p Submitted for publication Sponsored in part by National Science and Engineering Research Council
(Contract NAS1-18605)
(NASA-CR-189575; NAS 1.26:189575; ICASE-91-85; AD-A244826) Avail: NTIS HC/MF A03 CSCL 09/2

The convergence of finite dimensional controllers for infinite dimensional systems designed using approximations is examined. Stable coprime factorization theory is used to show that under the standard assumptions of uniform stabilizability/detectability, the controllers stabilize the original system for large enough model order. The controllers converge uniformly to an infinite dimensional controller, as does the closed loop response. Author

N92-20863# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
ARTIFICIAL NEURAL NETWORKS FOR SEISMIC DATA INTERPRETATION Semiannual Technical Summary Report, 1 Dec. 1990 - 30 Jun. 1991
Richard T. Lacoss, Robert K. Cunningham, Susan R. Curtis, and Michael C. Seibert 30 Jun. 1991 28 p
(Contract F19628-90-C-0002)
(AD-A245006; ESD-TR-91-170) Avail: NTIS HC/MF A03 CSCL 12/7

This is the second Semiannual Technical Summary of the MIT Lincoln Laboratory Artificial Neural Networks for Seismic Data Interpretation project. The effort during this period has concentrated upon phase labeling and event recognition networks for use in the DARPA/NMRO Intelligent Monitoring System (IMS) for seismic surveillance. Perception networks were developed with standard IMS parameters as inputs, improving upon the phase labeling performance of the expert IMS. These networks were developed and tested using data sets containing 5,000 to 10,000 arrivals. An initial version of the expert system achieved a 79 percent success rate compared with 86 percent for the neural network. A more recent and improved version of the expert system achieved rates of 87 percent compared with 90 percent for an updated neural network. Phase labeling experiments with sonograms and three-component autoregressive modeling for signal representation did not lead to further improvement. Two event labeling experiments were carried out using three-component autoregressive signal models with Radial Basis Function classification networks and involved on the order of 200 events. Success rates were 96.6 percent for an earthquake/nonearthquake classification experiment and 91 percent for a Kola Peninsula event recognition experiment. These results, using only autoregressive waveform representations, are encouraging but very preliminary. GRA

N92-20896# Naval Postgraduate School, Monterey, CA.
A HOPFIELD NETWORK APPROACH TO DIRECT ADAPTIVE CONTROL OF NONLINEAR SYSTEMS M.S. Thesis
Raymond S. Starsman Dec. 1991 118 p
(AD-A244667) Avail: NTIS HC/MF A06 CSCL 13/10

An automatic control system capable of controlling an unknown nonlinear system is designed using a direct adaptive control scheme, implemented with a Hopfield network. The application of this method to an arbitrary system is discussed in detail and three specific simulation studies are included. These studies include the implementation of the Hopfield network-based direct adaptive control system to a linear system, an inverted pendulum, and a nonlinear model of the NPS Autonomous Underwater Vehicle (AUV) with six degrees of freedom. The AUV simulation includes a three-dimensional trajectory-following algorithm and shows the ability of the Hopfield network to adapt to simultaneous ordered changes in the AUV's depth, speed, and course. Additionally, an analog circuit design is proposed which implements the automatic control scheme without the support of a microprocessor. The circuit was set up in SPICE and the simulation results as well as some limitations of the analog circuit implementation of the Hopfield network are presented. GRA

N92-20601 European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).
THE INTEGRATION AND TEST OF MODERN SPACECRAFT CONTROL SYSTEMS
N. Head and M. Jones *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 167-174 Previously announced in IAA as A91-47763 (For primary document see N92-20589 11-61)
Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

N92-20627 Avions Marcel Dassault-Breguet Aviation, Saint-Cloud (France).
THE ELECTRONIC COPILOT: A FRUITFUL EXPERIENCE TOWARD COMPLEX PROJECT MANAGEMENT USING ARTIFICIAL INTELLIGENCE IN THE SPACE DOMAIN

Yann Renault and Gilles Champigneux *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 443-462 Previously announced in IAA as A91-47789 (For primary document see N92-20589 11-61)
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N92-20921# Tokyo Univ., Sagamihara (Japan). Dept. of Aerospace Engineering.
MINIMAX OPTIMIZATION IN THE TIME DOMAIN
Toshiyuki Ohtsuka and Hironori Fujii *In its* Proceedings of the Symposium on Mechanics for Space Flight 1990 Mar. 1991 p 37-46 (For primary document see N92-20918 11-34)
Avail: NTIS HC/MF A05

64 NUMERICAL ANALYSIS

Includes iteration, difference equations, and numerical approximation.

N92-20062*# Old Dominion Univ., Norfolk, VA. Dept. of Electrical and Computer Engineering.
A NEW METHOD FOR RECOGNIZING QUADRIC SURFACES FROM RANGE DATA AND ITS APPLICATION TO TELEROBOTICS AND AUTOMATION Progress Report, period ending 29 Feb. 1992
Nicolas Alvertos and Ivan DCunha Feb. 1992 88 p
(Grant NAG1-1223)
(NASA-CR-189947; NAS 1.26:189947) Avail: NTIS HC/MF A05 CSCL 12A

A feature set of two dimensional curves is obtained after intersecting symmetric objects like spheres, cones, cylinders, ellipsoids, paraboloids, and parallelepipeds with two planes. After determining the location and orientation of the objects in space, these objects are aligned so as to lie on a plane parallel to a suitable coordinate system. These objects are then intersected with a horizontal and a vertical plane. Experiments were carried out with range images of sphere and cylinder. The 3-D discriminant approach was used to recognize quadric surfaces made up of simulated data. Its application to real data was also studied.
Author

N92-20103# Argonne National Lab., IL.
ON THE CALCULATION OF JACOBIAN MATRICES BY THE MARKOWITZ RULE
A. Griewank and S. Reese (Rensselaer Polytechnic Inst., Troy, NY.) 1991 12 p Presented at the Society for Industrial and Applied Mathematics (SIAM) Workshop on Automatic Differentiation of Algorithms: Theory, Implementation, and Application, Breckenridge, CO, 6-8 Jan. 1991
(Contract W-31-109-eng-38)
(DE92-006993; ANL/CP-75176; CONF-910189-4) Avail: NTIS HC/MF A03

The evaluation of derivative vectors can be performed with optimal computational complexity by the forward or reverse mode of automatic differentiation. This approach may be applied to evaluate first and higher derivatives of any vector function that is defined as the composition of easily differentiated elementary functions, typically in the form of a computer program. The more general task of efficiently evaluating Jacobians or other derivative matrices leads to a combinational optimization problem, which is conjectured to be NP-hard. Here, we examine this vertex elimination problem and solve it approximately, using a greedy heuristic. Numerical experiments show the resulting Markowitz scheme for Jacobian evaluation to be more efficient than column by column or row by row evaluation using the forward or the reverse mode, respectively.
DOE

N92-20104# Argonne National Lab., IL.
NEW NUMERICAL METHOD TO STUDY PHASE TRANSITIONS AND ITS APPLICATIONS
Jooyoung Lee and J. M. Kosterlitz Nov. 1991 12 p Presented at the Computer Aided Statistical Physics Conference, Taipei, Taiwan, 20-25 Jun. 1991
(Contract W-31-109-eng-38)
(DE92-006995; ANL/CP-75038; CONF-9106313-1) Avail: NTIS HC/MF A03

We present a powerful method of identifying the nature of transitions by numerical simulation of finite systems. By studying the finite size scaling properties of free energy barrier between competing states, we can identify unambiguously a weak first order transition even when accessible system sizes are L/(xi) less than 0.05 as in the five state Potts model in two dimensions. When studying a continuous phase transition we obtain quite accurate estimates of critical exponents by treating it as a field driven first order transition. The method has been successfully applied to various systems.
DOE

N92-20153# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE SINGULAR LINEAR QUADRATIC GAUSSIAN CONTROL PROBLEM
A. A. Stoorvogel 13 Nov. 1990 22 p
(Memo-COSOR-90-43; ETN-92-91118) Avail: NTIS HC/MF A03

The standard Linear Quadratic Gaussian (LQG) control problem for linear, finite dimensional time invariant systems is discussed without any assumptions on the system parameters. An explicit formula for the infimum over all internally stabilizing strictly proper compensators is given as well as a characterization when the infimum is attained.
ESA

N92-20161# Nijmegen Univ. (Netherlands). Dept. of Informatics.
TRANSFORMATIONAL REASONING ON PROCESS EXPRESSIONS
Huub vanThienen Apr. 1991 20 p
(TR-91-10; ETN-92-90898) Avail: NTIS HC/MF A03

Semantics of process algebras like CCS and languages for the specification of distributed systems like LOTOS are often given in terms of labeled transition systems. The main part of such a semantic definition is a logic of a proof system from which the possible transitions of a term (state) can be derived. Another style of semantic definition, in which the proof system is replaced by a set of equations, is proposed. Both definitions are proved equivalent. The advantage of using an equational semantics can be found in its use on proofs of theorems concerning properties of process expressions. The equational semantics allows an elegant proof style, based on transformational reasoning.
ESA

N92-20169# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
ROBUST STABILIZATION OF SYSTEMS WITH MULTIPLICATIVE PERTURBATIONS
A. A. Stoorvogel 21 Sep. 1990 14 p
(Memo-COSOR-90-36; ETN-92-91113) Avail: NTIS HC/MF A03

Robust stabilization of systems subject to multiplicative perturbations is discussed. For a given ball of perturbed systems around the nominal model, necessary and sufficient conditions were found under which a controller which stabilizes each system on the ball can be found. An explicit formula is given for a number gamma(*) with the property: the radius of the ball is less than gamma(*) if and only if there exists one controller which stabilizes all systems in the ball. Therefore gamma(*) is the best that can be done. Moreover, under an extra assumption and if they exist, an explicit formula for a controller which stabilizes all systems in the given ball is derived.
ESA

N92-20185# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
TWO-STAGE SELECTION PROCEDURES WITH ATTENTION TO SCREENING
Paul vanderLaan May 1991 19 p
(Memo-COSOR-91-12; ISSN-0926-4493; ETN-92-91172) Avail: NTIS HC/MF A03

Some literature concerning two stage selection procedures is

given. In general, the problem of selecting the normal population with largest mean from k (greater than or equal to 2). Normal populations with a common variance are considered. Special attention is drawn to two stage procedures with screening for selecting the best. Such a procedure consists of a combination of the subset selection approach and the indifference zone approach. The first stage is used for eliminating bad populations and the second stage is used to indicate the best population from the remaining part. ESA

N92-20278# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
EQUIVALENCE OF GIBBS AND EQUILIBRIUM STATES FOR HOMEOMORPHISMS SATISFYING EXPANSIVENESS AND SPECIFICATION
N. T. A. Haydn and D. Ruelle Aug. 1991 19 p
(PB92-115633; IHES/P/91/52) Avail: NTIS HC/MF A03
CSCL 12A

Let M be a compact metrizable space, f:M yields M, a homeomorphism satisfying expansiveness and specification, and A:M yields R, a function such that the absolute value: Summation from k = 0 to k = n-1 of (A(f(sup k)x)-A(f(sup k)y)) less than or = K(epsilon) less than infinity whenever n is greater than or = 1 and x,y are (epsilon,n)-close (i.e., d(f(sup k)x, f(sub k)y) less than epsilon for k = 0,..., n-1, some fixed choice of metric d and expansive constant epsilon greater than 0). Under these conditions, Bowen has shown that there is a unique equilibrium state rho for A. Assuming that K(epsilon) yields 0, it is shown that rho is also the unique Gibbs state for A. Quasi-Gibbs states are defined and it is shown that rho is the unique f-invariant quasi-Gibbs state for A. Author

N92-20347# Oak Ridge National Lab., TN.
MULTIPLE SCATTERING THEORY WITH SPACE FILLING POTENTIALS
W. H. Butler 1991 4 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005426; CONF-911202-25) Avail: NTIS HC/MF A01

A brief account of the current state or our understanding of full cell multiple scattering theory is given. The development of this understanding is also briefly outlined. DOE

N92-20499# National Aerospace Lab., Amsterdam (Netherlands). Space/Informatics Div.
STUDY ON EFFICIENT NUMERICAL TIME-INTEGRATION METHODS FOR SIMULATION OF MULTI-BODY SYSTEMS
P. Dieleman and A. A. tenDam 24 Jan. 1990 155 p
(Contract NIVR-02506-N)
(NLR-TP-90035-U; ETN-92-90963) Avail: NTIS HC/MF A08

The results of an evaluation of numerical integration schemes to be used for the digital simulation of second order ordinary differential equations, which are characteristic for multibody systems such as space manipulators, are described. Focus is on educated schemes for these types of systems. Main attention is paid to the Newmark and Wilson methods and the Nystrom version of the classical Runge-Kutta schemes. Simulations were carried out to illustrate advantages and disadvantages of the methods studied. Newmark type of numerical integration schemes are especially useful for long period simulation when a relatively low order of accuracy is required. For high accuracy simulations with acceptable performance Runge-Kutta-Nystrom types of schemes are promising. Consequences of weak and strong system nonlinearities on stability and accuracy of integration schemes were not studied explicitly and are advised as topics for further research. ESA

N92-20587# Amsterdam Univ. (Netherlands).
DESIGN, CONSTRUCTION AND BEAM TESTS OF THE HIGH RESOLUTION URANIUM SCINTILLATOR CALORIMETER FOR ZEUS Ph.D. Thesis
Johannes Adrianus Straver 1991 162 p Sponsored by Stichting voor Fundamenteel Onderzoek der Materie
(ETN-92-91190) Avail: NTIS HC/MF A08

The HERA (Hadron Electron Ring Collider Facility at Hamburg, Fed. Republic of Germany) is introduced and the importance of its ZEUS detector, which is equipped with a high resolution uranium scintillator counter which can absorb hadron jets and cope with the event rate, is outlined. The principles of high resolution hadron calorimetry and the studies which led to the design of the ZEUS calorimeter are discussed. The mechanical design of the ZEUS forward calorimeter, the mechanical finite element calculations and the production of the colorimeter modules are described. The results of the beam tests of the ZEUS forward calorimeter prototypes and the final full size forward calorimeter modules are shown. For individual titles, see N92-20588 through N92-20588.

N92-20588# Hamburg Univ. (Germany, F.R.).
TEST OF THE ZEUS FORWARD CALORIMETER PROTOTYPE
U. Behrens, J. Crittenden, K. Dierks, G. Drews, J. Engelen, B. Frisken, R. Hamatsu, D. Hanna, U. Holm, and M. A. Garcia (Universidad Autonoma de Madrid, Cantoblanco, Spain) et al *In* Amsterdam Univ., Design, Construction and Beam Tests of the High Resolution Uranium Scintillator Calorimeter for ZEUS 1991 p 87-105 Repr. from Nuclear Instruments and Methods in Physics Research, v. A289, 1990 p 115-138 Prepared in cooperation with Tokyo Univ., Japan; Freiburg Univ., Fed. Republic of Germany; Toronto Univ., Ontario; and Manitoba Univ., Winnipeg (For primary document see N92-20587 11-64)
Avail: NTIS HC/MF A08

ZEUS is one of two detectors for HERA (Hadron Electron Ring collider facility at Hamburg, Fed. Republic of Germany) and is equipped with a high resolution uranium scintillator calorimeter which can completely absorb the hadron jets and cope with the event rate. Four prototype modules following the same design as the ZEUS Forward Calorimeter (FCAL) modules were constructed and tested with electrons, hadrons and muons in the momentum range of 1 to 100 GeV/c. The main topics under investigation were: calibration, uniformity of response, noise, light yield, energy resolution and the electron to hadron response (e/h ratio). The results of the measurements are presented and the expected performance of the FCAL is discussed in light of these results. ESA

N92-20630# Technische Univ., Eindhoven (Netherlands).
COVERING CODES, PERFECT CODES, AND CODES FROM ALGEBRAIC CURVES Ph.D. Thesis
Gerhard J. M. vanWee 1991 219 p Sponsored by Netherlands Organization for Scientific Research
(ETN-92-90814) Avail: NTIS HC/MF A10

Topics of the mathematical research areas of combinations and algebraic coding theory are addressed. Eight papers and an introductory chapter are presented. The main issue is the 'minimal' cardinality of a code of given length n and given covering radius R. As an introduction to the 'covering' problem, a combinatorial problem known as the 'football pool problem' is described. For individual titles, see N92-20631 through N92-20638.

N92-20631# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
IMPROVED SPHERE BOUNDS ON THE COVERING RADIUS OF CODES M.S. Thesis - Leiden Univ.
Gerardus Joannes Mar vanWee *In its* Covering Codes, Perfect Codes, and Codes from Algebraic Curves 1991 p 31-55 Repr. from IEEE Transactions on Information Theory, v. 34, no. 2, Mar. 1988 p 237-243 (For primary document see N92-20630 11-64)
Avail: NTIS HC/MF A10

Lower bounds in the number of codewords in covering codes are addressed. Counting arguments are used to establish a significant and rather general improvement in the sphere covering bound. The sphere bound is a trivial lower bound on K(n,R), the minimal cardinality of any binary code of length n and with covering radius R. By simple arguments it is considerably improved, for example K(n,1) greater than or equal to 2 exp n/n for n even. A

table of lower and upper bounds on K(n, R) for n less than or equal to 33, R less than or equal to 10 is included. ESA

N92-20632# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
ON NORMAL AND SUBNORMAL Q-ARY CODES
Antoine C. Lobstein (Centre National de la Recherche Scientifique, Paris, France) and Gerhard J. M. vanWee *In its* Covering Codes, Perfect Codes, and Codes from Algebraic Curves 1991 p 56-69 Repr. from IEEE Transactions on Information Theory, v. 35, no. 6, Nov. 1989 p 1291-1295 Sponsored in part by Netherlands Organization for Scientific Research (For primary document see N92-20630 11-64)
Avail: NTIS HC/MF A10

The concepts of a normal and a subnormal code are generalized to codes over arbitrary alphabets. The q-ary case is extended to the notions of a normal code, a subnormal code, and the amalgamated direct sum construction. These concepts were defined in the binary case to investigate problems related to the covering radius of codes. Many nonbinary covering codes appear to be absubnormal. In particular, it is proved that every nonbinary nontrivial perfect code is absubnormal. Some linear programming lower bounds on ternary codes with covering radii 2 or 3 are included. ESA

N92-20633# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
ON THE NON-EXISTENCE OF CERTAIN PERFECT MIXED CODES
Gerhard J. M. vanWee *In its* Covering Codes, Perfect Codes, and Codes from Algebraic Curves 1991 p 70-73 Repr. from Discrete Mathematics, v. 87, 1991 p 323-326 Revised Sponsored by Netherlands Organization for Scientific Research (For primary document see N92-20630 11-64)
Avail: NTIS HC/MF A10

Partly based on techniques introduced in a previous study on improved sphere bounds on the covering radius codes, a nonexistence theorem concerning mixed perfect codes is proved. It is shown that if a nontrivial perfect mixed e code in Q(sub 1) times Q(sub 2) times...Q(sub)n exists, where the Q(sub i) are alphabets of size q(sub i), then the q(sub i), e and n satisfy certain divisibility conditions. In particular, all differences q(sub i) - q(sub j) must be divisible by e + 1. ESA

N92-20634# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
MORE BINARY COVERING CODES ARE NORMAL
Gerhard J. M. vanWee *In its* Covering Codes, Perfect Codes, and Codes from Algebraic Curves 1991 p 74-83 Repr. from IEEE Transactions on Information Theory, v. 36, no. 6, Nov. 1990 p 1466-1470 Presented at the 2nd Counting and Coding French-Chinese Conference, Paris, France, 6-8 Sep. 1989 Revised Sponsored by Netherlands Organization for Scientific Research (For primary document see N92-20630 11-64)
Avail: NTIS HC/MF A10

A study is presented which solves, in the case R = 1, the conjecture by Cohen, Lobstein, and Sloane that among the codes of length n with covering radius R having K(n,R) codewords, there is a normal code. In fact, every optimal binary code with covering radius R = 1 is proved to be normal. Codes with minimal distance 2R or 2R + 1 are also proved to be normal. A generalization of Frankl's construction of abnormal codes is given. ESA

N92-20635# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
BOUNDS ON PACKINGS AND COVERINGS BY SPHERES IN Q-ARY AND MIXED HAMMING SPACES
Gerhard J. M. vanWee *In its* Covering Codes, Perfect Codes, and Codes from Algebraic Curves 1991 p 84-100 Submitted for publication Sponsored by Netherlands Organization for Scientific Research (For primary document see N92-20630 11-64)
Avail: NTIS HC/MF A10

Results of a previous study in improved sphere bounds on the covering radius of codes are extended to codes over arbitrary alphabets (q-ary or mixed). In the previous study, general improvements on the sphere covering bound for binary covering codes were obtained. The exploitation of the main idea to obtain improved sphere bounds also for nonbinary codes is shown. Concentration is on general q-ary codes and on binary/ternary mixed codes. Special attention is paid to the football pool problem; a few new lower bounds are established. It is also shown how a similar method yields upper bounds on packing codes. ESA

N92-20636# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
GENERALIZED BOUNDS ON BINARY/TERNARY MIXED PACKING- AND COVERING CODES
J. H. vanLint, Jr. and Gerhard J. M. vanWee *In its* Covering Codes, Perfect Codes, and Codes from Algebraic Curves 1991 p 101-117 Submitted for publication Sponsored by Netherlands Organization for Scientific Research (For primary document see N92-20630 11-64)
Avail: NTIS HC/MF A10

Lower bounds on R coverings and upper bounds on e packings of F(sup t)(sub 3)F(sup b)(sub 2) are derived. These bounds are generalizations of the bounds for the cases R = 1, e = 1 or t = 0 or b = 0, which were already derived in a previous study of bounds on packings and coverings by spheres in q-ary and mixed Hamming spaces. This work is a supplement to that paper. The computed results for t + b less than or = to 13 and R, e less than or = to 3 are collected in a table. ESA

N92-20637# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
A NOTE ON PERFECT MULTIPLE COVERINGS OF THE HAMMING SPACE
Gerhard J. M. vanWee, G. D. Cohen, and S. N. Litsyn (Perm Academician D. N. Pryanishnikov Agricultural Inst., USSR) *In its* Covering Codes, Perfect Codes, and Codes from Algebraic Curves 1991 p 118-138 Presented at Designs and Codes, Oberwolfach, Fed. Republic of Germany, 1-7 Apr. 1990 Submitted for publication Sponsored in part by Netherlands Organization for Scientific Research (For primary document see N92-20630 11-64)
Avail: NTIS HC/MF A10

Let Q be an alphabet of size q greater than or equal to 2. The Hamming space Q to the nth power (Q(n)) that consists of all n tuples of elements of Q, is a metric space, provided with the Hamming distance function. A perfect multiple covering (PMC) is a code C in Q(n) such that there exist fixed numbers r and mu with the property that every word in Q(n) is within distance r from exactly mu codewords of C. A few constructions of PMC's are given, and the problem of determining all possible parameters of PMC's with r = 1 is investigated. ESA

N92-20638# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
WHICH LINEAR CODES ARE ALGEBRAIC-GEOMETRIC?
R. Pellikaan, B. Z. Shen, and Gerhard J. M. vanWee *In its* Covering Codes, Perfect Codes, and Codes from Algebraic Curves 1991 p 139-205 Repr. from IEEE Transactions on Information Theory, v. 37, no. 3, May 1991 Submitted for publication Sponsored in part by Netherlands Organization for Scientific Research (For primary document see N92-20630 11-64)
Avail: NTIS HC/MF A10

An infinite series of curves is constructed in order to show that all linear codes can be obtained from curves using Goppa's construction. If conditions are imposed on the degree of the divisor used, then criteria for linear codes to be algebraic geometric are derived. In particular, the family of q-ary Hamming codes are investigated, and it is proved that only those with redundancy one or two, and the binary code are algebraic geometric in this sense. For these codes a curve, rational points, and a divisor are explicitly

given. The triple is proved to be in a certain sense 'unique' in the case of the binary code. ESA

N92-20688# Rice Univ., Houston, TX. Dept. of Mathematical Sciences.
POLYHEDRAL METHODS FOR THE MAX-CUT PROBLEM Final Report, 1 Jun. 1990 - 31 May 1991
Robert E. Bixby 31 May 1991 3 p
(Grant AF-AFOSR-0273-90)
(AD-A244641; AFOSR-91-1003TR) Avail: NTIS HC/MF A01
CSCL 12/1

New polyhedral methods have been developed for the solution of a class of programming problems of importance in VLSI design. There methods have made possible an order-of-magnitude increase in the size of problems that can be successfully solved. GRA

N92-20799# International Centre for Theoretical Physics, Trieste (Italy).
GI(2/2)-OSCILLATORS AND GI(2/2)-DYNAMICAL SYMMETRY
A. H. Kamupingene and Nguyen Anh Ky Jul. 1991 17 p
(DE92-603625; IC-91/162) Avail: NTIS HC/MF A03

Extending the concept of the dynamical symmetry, we identify the Lie superalgebra GI(2/2) as a dynamical (super-)algebra of a class of non-canonical quantum systems, whose dynamical variables and quantities can be realized in terms of the GI(2/2)-generators. In this way, a new class of harmonic oscillators is established. As a consequence of the choice of the dynamical variables, the Heisenberg algebra and the Hermitian condition for the GI(2/2)-representations are also given. DOE

N92-20835 Tel-Aviv Univ. (Israel). Dept. of Applied Mathematics.
THE FOURIER METHOD FOR APPROXIMATE SOLUTION OF HYPERBOLIC EQUATIONS M.S. Thesis
Agbariah Kamal Nov. 1990 88 p In HEBREW; ENGLISH summary
(ITN-92-85155) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

Spectral and pseudo-spectral methods have been studied and the properties of the functions involved, for which these methods give high accuracy, known as spectral accuracy, were defined. ISA

N92-20866# California Univ., Berkeley. Dept. of Mathematics.
MATHEMATICAL TOOLS FOR IMAGE RECONSTRUCTION Final Report, 1 Aug. 1988 - 31 Jul. 1991
F. A. Grunbaum Jul. 1991 5 p
(Grant AF-AFOSR-0250-88; AF Proj. 2304)
(AD-A243838; AFOSR-91-0940TR) Avail: NTIS HC/MF A01
CSCL 12/9

During the period covered by the grant four areas were worked on: (1) Diffuse tomography, (2) Concentrating a signal in the physical and spectral domains, (3) New explicit solutions for the Kadomtsev-Petviashvili equation, and (4) Time and band limiting on the symmetric group. GRA

N92-20886# Clark-Atlanta Univ., GA.
NONLINEAR, SINGULAR OSCILLATORY SYSTEMS Final Report, 15 Feb. 1988 - 31 Aug. 1991
Ronald E. Mickens 31 Aug. 1991 15 p
(Contract DAAL03-88-G-0002)
(AD-A244724; ARO-25484.10-EG-H) Avail: NTIS HC/MF A03
CSCL 12/1

Recently, a new class of nonlinear oscillatory equations have arisen. They have the property that the nonlinear terms can become unbounded for finite values of the variable and/or its derivative. For such systems the usual method of analyses do not apply. This report summarizes our investigations on such systems. In particular, we have carried out a detailed investigation of the mathematical properties of such systems using phase-space methods, perturbation theory based on the Hopf bifurcation theorem, and the method of harmonic balance. Properties of coupled singular oscillators were also examined. GRA

N92-20906 Tel-Aviv Univ. (Israel). Dept. of Applied Mathematics.
SOLUTION OF AN EIGENVALUE PROBLEM FOR AN ELLIPTIC OPERATOR WITH SPECIAL BOUNDARY CONDITIONS USING THE BOUNDARY ELEMENT METHOD M.S. Thesis
Moshe Federbush Jan. 1990 86 p In HEBREW; ENGLISH summary
(ITN-92-85156) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

The Boundary Element Method (BEM) was used to determine eigenvalues providing non-trivial solutions for the Helmholtz equation in the case of a harmonically time-dependent sound wave passing through an infinite cylindrical tube with a rectangular cross-section. In the case examined, where the speed of the sound wave is slower than its free-space speed, some of the eigenvalues are negative; the aim was to develop a method to calculate these eigenvalues, which have corresponding eigenfunctions which rise steeply at the boundary. The problem was solved in the rectangular domain to enable numerical and analytical results to be compared, but the method applies also to other domains. Green's third identity was used to pass from a differential problem to a boundary integral equation and to develop a suitable Green function. This method leads to transition from a 2-dimensional to a 1-dimensional problem. Trial functions were used to approximate solutions for sections of the boundary, which was partitioned for this purpose. The computer was applied to determining solutions of the problem for various partitioning of the boundary. The eigenvalue results, which led to eigenfunctions which were exponential in x and y were improved by using a finer subdivision towards the corners of the rectangle, where the solution becomes steeper. It was attempted to improve the results by extrapolation, based on the results obtained for different partitions of the boundary. The results were compared with those obtained by the Finite Element Method. ISA

N92-20985# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
DESIGN OF PIPELINED LATTICE IIR DIGITAL FILTERS Report, Jul. - Dec. 1991
Jin-Gyun Chung and Keshab K. Parhi Nov. 1991 6 p Presented at the 25th Asilomar Conference on Signals, Systems, and Computers, Pacific Grove, CA, 4-6 Nov. 1991
(Contract DAAL03-90-G-0063)
(AD-A244545; ARO-27076.20-EL) Avail: NTIS HC/MF A02
CSCL 12/1

Lattice structures exhibit good finite word length properties. In some real-time applications, high speed is very crucial to the system performance along with finite word length effects. Although lattice filters can be pipelined by cut-set localization procedure, no sample rate increase can be achieved by that method. In this paper, a pipelining method in lattice digital filters is introduced. This pipelining method is based upon constrained infinite-duration impulse-response (IIR) digital filter design method by which pipelined direct-form filters are designed. These direct-form filters are transformed to pipelined lattice digital filters. It is shown that the roundoff error and the number of multiply/add operations of the resulting pipelined lattice filters are smaller than those of the pipelined lattice filters obtained by applying look-ahead on direct-form nonpipelined digital filters. GRA

65 STATISTICS AND PROBABILITY

Includes data sampling and smoothing; Monte Carlo method; and stochastic processes.

N92-20133# Oak Ridge National Lab., TN.
FROM PATH INTEGRALS TO ANYONS
G. S. Canright Jan. 1992 14 p Presented at the International Center for Theoretical Physics Course on Path Integration, Trieste (Italy), 26 Aug. - 2 Sep. 1991 Prepared in cooperation with Tennessee Univ., Knoxville
(Contract DE-AC05-84OR-21400)
(DE92-006847; CONF-9108193-1) Avail: NTIS HC/MF A03

I offer a pedagogical review of the homotopy arguments for fractional statistics in two dimensions. These arguments arise naturally in path-integral language since they necessarily consider the properties of paths rather than simply permutations. The braid group replaces the permutation group as the basic structure for quantum statistics; hence properties of the braid group on several surfaces are briefly discussed. Finally, the question of multiple (real-space) occupancy is addressed; I suggest that the 'traditional' treatment of this question (i.e., an assumption that many-anyon wavefunctions necessarily vanish for multiple occupancy) needs reexamination. DOE

N92-20151# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
AN ALGORITHM FOR THE VEHICLE ROUTING PROBLEM WITH STOCHASTIC DEMANDS
M. W. P. Savelsbergh and M. Goetschalckx (Georgia Inst. of Tech., Atlanta.) Oct. 1990 21 p Sponsored in part by Georgia Inst. of Tech.
(Memo-COSOR-90-40; ETN-92-91116) Avail: NTIS HC/MF A03

Motivated by the fixed routes problem, where the objective is to design a set of routes to be operated unchanged over a period of time, the vehicle routing problem with stochastic demands is studied. An algorithm is developed based on a stochastic programming model with recourse. Computational experiments show that the algorithm compares favorably to existing algorithms. ESA

N92-20152# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE SET OF GEOMETRICALLY INFINITELY DIVISIBLE DISTRIBUTIONS
F. Steutel Nov. 1990 11 p
(Memo-COSOR-90-42; ETN-92-91117) Avail: NTIS HC/MF A03

It was previously shown that the set of geometrically infinitely divisible distributions coincides with the closure of the set of compound geometric distributions. It is proven that from this, it follows that (mixtures of) log convex densities on (0, infinity) are geometrically infinitely divisible. The results of Pillai and Sandya (1990) are easy consequences of this. ESA

N92-20155# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE DESIGN AND COMPLEXITY OF EXACT MULTI-LAYERED PERCEPTRONS
P. J. Zwietering, Emile H. L. Aarts (Philips Gloeilampenfabrieken N.V., Eindhoven, Netherlands), and Jaap Wessels Apr. 1991 26 p
(Memo-COSOR-91-08; ISSN-0926-4493; ETN-92-91128) Avail: NTIS HC/MF A03

The network complexity of multilayered perceptrons for solving exactly a given problem is investigated. The study is limited to the class of combinatorial optimization problems. It is shown how these problem can be reformulated as binary classification problems and how they can be solved by multilayered perceptrons. ESA

N92-20181# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
FLEXIBLE ASSEMBLY AND SHORTEST QUEUE PROBLEMS
Ivo J. B. F. Adan, Jaap Wessels, and W. Henk M. Zijm (Philips Gloeilampenfabrieken N.V., Eindhoven, Netherlands) Sep. 1990 21 p
(Memo-COSOR-90-34; ETN-92-91111) Avail: NTIS HC/MF A03

For the design of flexible assembly systems an iterative approach seems advisable. Such an approach would require the evaluation of several alternative designs. Therefore it is necessary that individual designs can be evaluated very efficiently. It is argued that extended shortest queue models can play an important role in designing flexible assembly systems. Consequently, it would be essential to have efficient methods to evaluate shortest queue models. A new approach for shortest queue models is presented and its use for several variants is shown. The approach uses mixtures of product forms as approximate solutions for the equilibrium distribution of the Markov chain. Although no rigorous proofs are presented, it is indicated that the exact solution can be approximated deliberately well in this way with the particular property that the approach also generates upper and lower bounds. ESA

N92-20183# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
ANALYSIS OF THE ASYMMETRIC SHORTEST QUEUE PROBLEM
Ivo J. B. F. Adan, Jaap Wessels, and W. Henk M. Zijm (Philips Gloeilampenfabrieken N.V., Eindhoven, Netherlands) Oct. 1990 68 p Revised
(Memo-COSOR-90-39; ETN-92-91115) Avail: NTIS HC/MF A04

A system consisting of two parallel servers with different service rates is studied. Jobs arrive according to a Poisson stream and generate an exponentially distributed workload. On arrival a job joins the shortest queue and in case both queues have equal lengths, he joins the first queue with probability q and the second one with probability 1-q, where q is an arbitrary number between 0 and 1. In a previous paper it was shown for the symmetric problem, that is for equal service rates and $q = 1/2$, that the equilibrium distribution of the length of the two queues can be exactly represented by an infinite sum of product form solutions by using an elementary compensation procedure. A similar product form result for the asymmetric problem by using a generalization of the compensation procedure is proven. It is shown that the product form representation leads to a numerically efficient algorithm. Essentially, the method exploits the convergence properties of the series of product forms. Because of the fast convergence an efficient method is obtained with upper and lower bounds for the exact solution. For states further away from the origin, the convergence is faster. This aspect is also exploited. ESA

N92-20184# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
PROPERTIES OF FOURIER-STIELTJES SEQUENCES OF DISTRIBUTIONS WITH SUPPORT IN (0,1)
R. J. G. Wilms Mar. 1991 17 p
(Memo-COSOR-91-06; ETN-92-91126) Avail: NTIS HC/MF A03

In the literature, the relation between characteristic functions and distribution functions is described by the uniqueness theorem, the inversion theorem, the convolution theorem and the continuity theorem. The Fourier-Stieljes sequence of distribution functions that only have probability mass in the half open interval (0,1) is considered. The connection between properties of this Fourier-Stieltjes sequence and properties of the distribution is studied. ESA

N92-20233# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
A NOTE ON THE USE OF THE PRODUCT OF SPACINGS IN BAYESIAN INFERENCE
Frank P. A. Coolen and M. J. Newby Sep. 1990 15 p Submitted for publication
(Memo-COSOR-90-35; ETN-92-91112) Avail: NTIS HC/MF A03

The product of spacings is suggested as an alternative to the likelihood in Bayesian inference. It is shown that the product of spacings can be used in place of the likelihood in Bayesian inference without losing the structure and properties of the Bayesian inference without losing the structure and properties of the Bayesian method. The method is shown to have computational advantages. ESA

N92-20883# Rice Univ., Houston, TX. Dept. of Statistics.
SOME PROBLEMS IN DENSITY ESTIMATION, MODELING, AND TIME SERIES ANALYSIS Final Report, 1 Aug. 1988 - 31 Jul. 1991
James R. Thompson 26 Sep. 1991 7 p
(Contract DAAL03-88-K-0131)
(AD-A244721; ARO-26108.1-MA) Avail: NTIS HC/MF A02
CSCL 12/3

Work in density estimation resampling has been carried out with Dr. Malcolm Taylor of BRL. Simulation based estimation has been applied to problems ranging from marketing to oncology. Two doctoral dissertations were written on the subject of nonparametric regression. The effects of more active public health intervention to halt the AIDS epidemic were considered. New algorithms for density estimation in several dimensions were developed. The estimation of the parameters characterizing a time series was pursued using both frequency and time domain techniques. The possibility that chaos is an artifact of inappropriate modeling was investigated. GRA

N92-20907 Tel-Aviv Univ. (Israel). Dept. of Pure Mathematics.
GENERALIZED CORRELATION SEQUENCES M.S. Thesis
David Meiri Oct. 1990 75 p
(ITN-92-85160) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

Chapter 1 discusses ordinary and generalized correlation sequences, and introduces the Kronecker and Abramov factors. Chapter 2 summarizes material from measure theory and ergodic theory, which is needed later in the work. It includes conditional expectation, disintegration of measure, the ergodic decomposition of product measures, conditional product measures on fiber products, group extensions, and nilpotent systems. Chapter 3 contains a proof that every generalized correlation sequence can be realized in a nil-system. In Chapter 4, a generalized correlation sequence, which cannot be obtained in an Abramov system, is constructed. ISA

N92-20908 Tel-Aviv Univ. (Israel). Dept. of Mathematics.
RELATIVISTIC AND NON-RELATIVISTIC STOCHASTIC KINEMATICS: A UNIFIED APPROACH M.S. Thesis
Igal Milchtaich Sep. 1990 41 p
(ITN-92-85161) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

It was found possible to give the equations of stochastic kinematics a covariant form, symmetric in respect to space and time. These equations were derived relatively simply, by exploiting the homogeneity of the parameter which describes the motion through space-time of the particles in question. Current and osmotic velocities can be defined as contravariant four-vectors and the particle density as a tensor density. These definitions use a general scheme for deriving local properties from particle-related properties. Although this scheme, since it is symmetric with respect to the space components and the time component of space-time, is most naturally put in the relativistic context, a non-relativistic reasoning is also possible. It is shown that a local property thus defined is a limit value of values measured by measurement devices, as the resolution of these devices is being increased. ISA

N92-20940# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
ON SOME MISCONCEPTIONS ABOUT SUBJECTIVE PROBABILITY AND BAYESIAN INFLUENCE
Frank Coolen May 1991 12 p
(Memo-COSOR-91-11; ISSN-0926-4493; ETN-92-91131) Avail: NTIS HC/MF A03

Some misconceptions about subjective probability and Bayesian inference exist that can be obstacles for acceptance and use of these concepts in practice. The statement that 'humans are not natural Bayesian personalists' is discussed, together with a formal mistake inherent to preposterior analysis. The most important problem that has to be solved for practical acceptance is correct measurement of subjective probability, where the random variable of interest must be easily interpretable. ESA

N92-20967# Naval Postgraduate School, Monterey, CA.
A STOCHASTIC APPROACH TO SOLVING THE 2-1/2 DIMENSIONAL WEIGHTED REGION PROBLEM M.S. Thesis
Cary Allen Hilton, Jr. Jun. 1991 128 p
(AD-A245060) Avail: NTIS HC/MF A07 CSCL 17/7

This thesis describes a method of computing a feasible path solution for the anisotropic weighted region problem. Heuristics are used to locate an initial starting solution. This starting solution is iteratively improved using a golden ratio search to produce a solution within a specified tolerance. The path solution is then randomly perturbed or detoured through different region frontiers, and the golden ratio search is again applied. These random detours are controlled by a process known as simulated annealing, which determines the number of detours made and decides whether to accept or reject each path solution. Better solutions are always accepted and worse solutions are accepted based on a probability distribution. Accepting worse solutions allows an opportunity to escape from a local minimum condition and continue the search for the optimal path. Since an exhaustive search is not performed, the globally optimal path may not be found, but a feasible path can be found with this method. GRA

N92-21014# North Carolina Univ., Chapel Hill. Dept. of Statistics.
RESEARCH IN STOCHASTIC PROCESSES Final Report, 1 Sep. 1990 - 31 Aug. 1991
Stamatis Cambanis and M. R. Leadbetter 31 Aug. 1991 57 p
(Grant AF-AFOSR-0030-91)
(AD-A244601; AFOSR-91-1037TR) Avail: NTIS HC/MF A04 CSCL 12/3

Research was conducted and directed in the area of stochastic processes and their applications in engineering, neurophysiology, and oceanography. More detailed descriptions of the work of all participants is given in the main body of the report: Sampling designs for time series; Signal quantization; Wavelet approximation of random signals; Gaussian and non-Gaussian processes; Nonstationary processes; Exchangeable processes; Random fields; Point processes and random measures; Nonlinear filtering; Infinite dimensional stochastic differential equations; Stochastic partial differential equations; Random measures associated with high levels; Limit theorems for random measures; and Parameter estimation under dependence. GRA

66 SYSTEMS ANALYSIS

Includes mathematical modeling; network analysis; and operations research.

N92-20966# Carnegie-Mellon Univ., Pittsburgh, PA. Software Engineering Inst.
DESIGN SPECIFICATIONS FOR ADAPTIVE REAL-TIME SYSTEMS Final Report
Randall W. Lichota Dec. 1991 32 p
(Contract F19628-90-C-0003)
(AD-A245051; CMU/SEI-91-TR-20; ESD-91-TR-20) Avail: NTIS HC/MF A03 CSCL 12/5

The design specification method described in this report treats a software architecture as a set of runtime entities, including tasks and external input/output elements, which interact either via messages or shared data structures. Tasks have a single thread of execution and represent program units that may be executed concurrently. External input elements produce input requests that in turn trigger a set of low-level activities to be executed by tasks. External output elements consume results that are produced by tasks. The specification method discussed here facilitates the description of the dynamic structure of runtime entities, the synchronization and communication between these entities, and their resource consumption and production properties (which include timing and sizing). GRA

N92-20996# Naval Postgraduate School, Monterey, CA.
A STUDY OF THE DIFFRACTION BEHAVIOR AND RESOLUTION CRITERIA FOR PATTERN RECOGNITION FOR A PROPOSED MULTIPLEXED IMAGING TECHNIQUE M.S. Thesis
Brian J. Musselman Sep. 1991 171 p
(AD-A245066) Avail: NTIS HC/MF A08 CSCL 12/9

This project quantifies several aspects of a new multiplexed

imaging technique. The novel approach of this technique involves the use of encoding masks derived from a basis set of two-dimensional Walsh functions. There were two distinct problems addressed. First, a study of computer simulated diffraction patterns of the photon flux through these encoding masks yielded design constraints to be incorporated into a prototype system. The constraints were expressed in a simple mathematical relation in terms of wavelength, diffraction angle, and spatial frequency. A second problem addressed the minimum spatial resolution required for pattern recognition. The conclusion was that the minimum number of resolution elements necessary for pattern recognition is 64 in each direction. This determination also fixed the minimum size of the basis set of two-dimensional Walsh functions required for multiplexing, as well as the number of pixels required to display the image. GRA

N92-21070# Los Alamos National Lab., NM.
AVERAGE DEPLOYMENTS VERSUS MISSILE AND DEFENDER PARAMETERS
Grégory H. Canavan Mar. 1991 15 p
(Contract W-7405-eng-36)
(DE92-003989; LA-11856-MS) Avail: NTIS HC/MF A03

This report evaluates the average number of reentry vehicles (RVs) that could be deployed successfully as a function of missile burn time, RV deployment times, and the number of space-based interceptors (SBIs) in defensive constellations. Leakage estimates of boost-phase kinetic-energy defenses as functions of launch parameters and defensive constellation size agree with integral predictions of near-exact calculations for constellation sizing. The calculations discussed here test more detailed aspects of the interaction. They indicate that SBIs can efficiently remove about 50 percent of the RVs from a heavy missile attack. The next 30 percent can be removed with two-fold less effectiveness. The next 10 percent could double constellation sizes. DOE

N92-20783# Dassault Espace, Saint-Cloud (France).
QUALITY AND SAFETY OF OPERATION: REVIEW OF EXPERIENCE [QUALITE ET SURETE DE FONCTIONNEMENT: LE RETOUR D'EXPERIENCE]
Jean-Gerard Roussel *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 455-457 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

N92-20785*# National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.
AN OUTLOOK FOR THE TWENTY FIRST CENTURY AS TO LAUNCH OPERATIONS, FACILITIES, AND SYSTEMS
Joseph P. Loftus, Jr. *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 467-474 (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

67 THEORETICAL MATHEMATICS

Includes topology and number theory.

N92-20274# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
HARMONIC MORPHISMS AND HERMITIAN STRUCTURES ON EINSTEIN 4-MANIFOLDS
J. C. Wood Oct. 1991 41 p
(PB92-114123; IHES/M/91/67) Avail: NTIS HC/MF A03
CSCL 12A

It is shown that a submersive harmonic morphism from an orientable Einstein 4-manifold M(sup 4) to a Riemann surface, or a conformal foliation of M(sup 4) by minimal surface, determines an (integrable) Hermitian structure with respect to which it is harmonic. Conversely, any nowhere-Kahler Hermitian structure of an orientable anti-self-dual Einstein 4-manifold arises locally in this way. In the case M(sup 4) = R(sup 4), it is shown that a Hermitian structure, viewed as a map into S(sup 2), is a harmonic morphism; in this case and for S(sup 4), C(P(sup 2)) all (submersive) harmonic morphisms are determined to surfaces locally, and nondegenerate critical points, globally. Author

70 PHYSICS (GENERAL)

For precision time and time interval (PTTI) see *35 Instrumentation and Photography;* for geophysics, astrophysics or solar physics see *46 Geophysics, 90 Astrophysics,* or *92 Solar Physics.*

N92-20312# National Inst. of Standards and Technology, Gaithersburg, MD. Physics Lab.
THE INTERNATIONAL SYSTEM OF UNITS (SI) Final Report
Barry N. Taylor, ed. Aug. 1991 64 p
(PB92-109032; NIST/SP-330) Avail: NTIS HC/MF A04; also available SOD HC $3.50 as 003-003-03099-6 CSCL 20C

The booklet is the U.S. edition of the English language translation of the 6th edition of Le Systeme International d'Unites (SI), the definitive reference on the SI published in 1991 by the International Bureau of Weights and Measures (BIPM) in the French language. The U.S. edition conforms in substance with the English language translation that follows the French language text in the BIPM publication. To make the booklet helpful to the broadest community of users in the U.S., it was necessary to follow current Federal policy, to recognize present U.S. practices as they are found in the literature of the authors domestic voluntary standards organizations such as ASTM and IEEE, and to use American spelling of certain words. Author

N92-20316# National Inst. of Standards and Technology, Boulder, CO. Electromagnetic Technology Div.
MAGNETIC MEASUREMENTS FOR HIGH ENERGY PHYSICS APPLICATIONS Final Report, 15 Jun. 1988 - 14 Jun. 1991
R. B. Goldfarb Aug. 1991 69 p
(Contract DE-AI05-85ER-40240)
(PB92-112358; NISTIR-3975) Avail: NTIS HC/MF A04 CSCL 20C

A collection of papers are presented which describe magnetic measurements on multifilamentary Nb-Ti superconductor wires and cables as a function of magnetic field and time at liquid helium temperatures. Ac losses and interfilament coupling by proximity effect and eddy currents are examined. Flux creep was studied under different experimental conditions. A Hall probe magnetometer, which was used to measure magnetization and flux creep in the presence of a transport current, is described. A method for increasing the critical current of superconducting cable by controlling twist pitch is demonstrated. A critical state model for the magnetization of superconductors was developed for samples with field dependent critical current density and rectangular cross section. Author

N92-20515*# Baker Consulting, Walnut Creek, CA.
ADVANCED FLOW-POLISHING AND SURFACE METROLOGY OF THE SO56 X RAY TELESCOPE Final Report
2 Mar. 1992 25 p
(NASA Order H-08082-D; NASA Order H-11210-D)
(NASA-CR-190079; NAS 1.26:190079) Avail: NTIS HC/MF A03 CSCL 20C

The surface finishing of X ray grazing incidence optics is a most demanding area of optical processing, both in terms of metrology and application of optical finishing techniques. An existing optical mirror was processed using a new removal technique that uses a jet of finely dispersed and extremely small particles that impact a surface, which under the correct conditions, produces an ultrasmooth surface, especially on aspheric curvatures. The surfaces of the SO56 mirror are tapered conical shapes that have a continuously changing radius with the primary mirror having a parabolic shape and the secondary mirror a hyperbolic shape. An optical ray trace that was conducted of a telescope used the

measured parameters from the existing substrates to set up the prescription for the optical layout. The optimization indicated a wavefront performance of 0.10 A at 0.633 micron. Author

71 ACOUSTICS

Includes sound generation, transmission and attenuation. For noise pollution see *45 Environmental Pollution.*

N92-20360 Pennsylvania State Univ., University Park.
NONLINEAR ACOUSTIC PROPAGATION OF SHOCK WAVES THROUGH THE ATMOSPHERE WITH MOLECULAR RELAXATION Ph.D. Thesis
Jongmin Kang 1991 220 p
Avail: Univ. Microfilms Order No. DA9127350

A theory is developed for determining a detailed rise phase of weak shocks based on molecular relaxation. The principal hypothesis is that the molecular relaxation process is so fast that a frozen shock profile is achieved very quickly within a length scale of the atmospheric inhomogeneity. By the frozen profile assumption, the augmented Burger's equation and the relaxation equation are reduced to equations which can be solved by numerical integration. The central issue is what is the most dominant mechanism for rise phase of weak shocks. Molecular relaxation mechanism has been believed to be a predominant mechanism; however, there exists no complete theory and analysis. From the comparison of theoretical predictions with experimental shock profiles of sonic boom, it is found that molecular relaxation cannot sufficiently explain the finite rise time of sonic booms. The rise times of experimental data are larger than predictions by a factor of 2 to 5. Atmospheric turbulence may be a predominant mechanism for this normal thickening effect. However, present theory provides a lower bound to rise time and an upper bound to loudness. It is possible to modify existing programs for sonic boom propagation without much effort. Dissert. Abstr.

N92-20381# Sheffield Univ. (England). Dept. of Automatic Control and Systems Engineering.
PARAMETRIC ANALYSIS OF FIELD CANCELLATION IN A THREE-DIMENSIONAL PROPAGATION MEDIUM
M. O. Tokhi and R. R. Leitch (Heriot-Watt Univ., Edinburgh, Scotland) May 1991 35 p
(RR-430; ETN-92-90653) Avail: NTIS HC/MF A03

An analysis of the process of field cancellation in a three dimensional non dispersive propagation medium is presented. The analysis is presented from the perspective of the design of Active Noise Control (ANC) systems for broadband noise emanating from compact sources. The analysis of cancellation is presented in parametric terms, both in time and in frequency, leading to a three dimensional description of cancellation that is suitable for determining the geometrical arrangement for a given degree of cancellation. The parameters established can be used in the design of ANC systems. The parameters can also be used to determine the performance of the resulting ANC system. ESA

N92-20387# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de la Physique Generale.
DEFINITION OF ACOUSTIC MEASUREMENTS IN THE ANECHOIC CHAMBER OF PALAISEAU (FRANCE) AND THE WIND TUNNEL AT NANTES (FRANCE) [DEFINITION DE MESURES TECHNIQUES EN CHAMBRE ANECHOIQUE A PALAISEAU ET EN SOUFFLERIE A NANTES]
P. Malbequi, Y. Delrieux, and S. Canard-Caruana Feb. 1991 12 p In FRENCH
(Contract DRET-89-001-118)
(ONERA-RT-16/3641-PY; ETN-92-90875) Avail: NTIS HC/MF A03

Software developed to take three dimensional effects into account in the study of acoustic propagation at low latitudes is described. The basic experiments on diffraction due to obstacles and propagation in the presence of cross wind are described. These experiments are carried out in an anechoic chamber wind tunnnel. ESA

N92-20388# Office National d'Etudes et de Recherches Aerospatiales, Paris (France). Direction de la Physique Generale.
BLADE-VORTEX NOISE ON A HELICOPTER MAIN ROTOR. STUDY OF THE STRONG TWO DIMENSIONAL INCOMPRESSIBLE INTERACTION [BRUIT D'INTERACTION PALE-TOURBILLON SUR UN ROTOR PRINCIPAL D'HELICOPTERE. ETUDE DE L'INTERACTION FORTE EN BIDIMENSIONNEL INCOMPRESSIBLE]
G. Rahier Jan. 1991 40 p In FRENCH
(Contract DRET-89-001-118)
(ONERA-RT-96/5094-PY; ETN-92-90876) Avail: NTIS HC/MF A03

A parametric study of the strong interactions in incompressible two dimensions is described. The study allows for the elaboration of an air vortex model compatible with the calculations of such interactions and allows the effects of various parameters of the interaction to be elucidated. Parameters such as the position of the air vortex, its intensity, the dimensions of its viscous core, and its profile incidence are identified. The results obtained using the S2DI code are compared to other calculation results, especially those based on Navier-Stokes equations. It is concluded that rapid calculation of interaction noise with relatively correct prediction capacity can be carried out in most cases. ESA

N92-20428 Florida Atlantic Univ., Boca Raton.
A NUMERICAL STUDY OF FUSELAGE SCATTERING EFFECTS ON ROTOR NOISE Ph.D. Thesis
Noureddine Atalla 1991 236 p
Avail: Univ. Microfilms Order No. DA9134559

The effects are considered of scattering on the sound radiation from rotating sources. The study was carried out using a combined numerical implementation of ray acoustics and the paraxial ray approximation. A detailed description of the theoretical background to these methods are presented, along with a description of their numerical implementation. Application of the method to classical problems is considered to prove the accuracy and the power of the approach. Application of the method to some typical problems involving scattering of noise from propellers and rotors is presented. It is found that for impulsive acoustic signatures, the scattering effects are important especially in the sideline direction from a helicopter fuselage. The effects of sharp edges on the steady loading noise from tilt-rotor configurations indicates that there is a new mechanism for generating impulsive acoustic signatures caused by scattering caused by sharp edges of the fuselage. The acoustic signature generated by this mechanism can appear very similar to other types of impulsive source generated by aerodynamic interactions on the blade and therefore must be important. This type of source can be eliminated if the fuselage has rounded edges. Flow effects on scattering problems were also considered. It is concluded that scattering effects cannot be ignored for highly directional rotating sources next to rigid scattering objects as is always the case for propellers and helicopter rotors.
Dissert. Abstr.

N92-20461# Rolls-Royce Ltd., Derby (England).
THE IMPACT OF AIRCRAFT NOISE CONTROL TECHNOLOGY
M. J. T. Smith 7 May 1991 9 p Presented at the Canadian Aeronautics and Space Seminar, Montreal, Quebec, 7 May 1991
(PNR-90846; ETN-92-90796) Copyright Avail: NTIS HC/MF A02

Reductions made in aircraft noise since the first generation jet aircraft are reviewed. The critical facts presently underpinning the airport noise situation are listed. The technologies which are responsible for the reduction in aircraft noise are reviewed and illustrated. Progress in noise control around airports is considered and future prospects concerning aircraft noise are discussed.
ESA

N92-20479*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
ANNOYANCE CAUSED BY AIRCRAFT EN ROUTE NOISE
David A. McCurdy Mar. 1992 40 p
(NASA-TP-3165; L-16975; NAS 1.60:3165) Avail: NTIS HC/MF A03 CSCL 20A

A laboratory experiment was conducted to quantify the annoyance response of people on the ground to enroute noise generated by aircraft at cruise conditions. The en route noises were ground level recordings of eight advanced turboprop aircraft flyovers and six conventional turbofan flyovers. The eight advanced turboprop enroute noises represented the NASA Propfan Test Assessment aircraft operating at different combinations of altitude, aircraft Mach number, and propeller tip speed. The conventional turbofan en route noises represented six different commercial airliners. The overall durations of the en route noises varied from approximately 40 to 160 sec. In the experiment, 32 subjects judged the annoyance of the en route noises as well as recordings of the takeoff and landing noises of each of 5 conventional turboprop and 5 conventional turbofan aircraft. Each of the noises was presented at three sound pressure levels to the subjects in an anechoic listening room. Analysis of the judgments found small differences in annoyance between three combinations of aircraft type and operation. Current tone and corrections did not significantly improve en route annoyance prediction. The optimum duration-correction magnitude for en route noise was approximately 1 dB per doubling of effective duration. Author

N92-20698# Naval Ocean Systems Center, San Diego, CA.
INTEGRATED MODELS OF SIGNALS AND BACKGROUND FOR AN HMM/NEURAL NET OCEAN ACOUSTIC EVENTS CLASSIFIER
W. Y. Huang and R. C. Rose Dec. 1991 7 p
(AD-A244889) Avail: NTIS HC/MF A02 CSCL 17/1

This paper investigates the use of Hidden Markov models (HMMs) for the classification and detection of ocean acoustic events in a nonstationary ocean background. A statistical formalism is described for integrating models for dynamic acoustic events and ocean background into a unified statistical framework. In this framework, both signal processes and background processes are modeled as HMMs, and signal classification is performed by obtaining the likelihood of a corrupted observation sequence through a combined state space of signal and background. Techniques are presented for estimating the acoustic event model parameters from training exemplars that are observed in these difficult background conditions. Finally, a novel neural network technique is proposed for the automatic learning of the nonlinear mechanism through which signal and background observations interact. Experimental results are presented. GRA

N92-20825# Scripps Institution of Oceanography, La Jolla, CA. Marine Physical Lab.
ACOUSTIC REVERBERATION EXPERIMENT PLANNING Final Report, 1 Jan. - 31 Dec. 1990
W. S. Hodgkiss and J. A. Hildebrand Nov. 1991 5 p
(Contract N00014-90-J-1577)
(AD-A244784; MPL-U-80/91) Avail: NTIS HC/MF A01 CSCL 08/3

The Office of Naval Research initiated a series of acoustic reverberation planning meetings in FY89. As an outgrowth of these meetings, surface and bottom reverberation field measurement groups were formed in FY 90 to engage in the detailed planning of surface and bottom reverberation experiments. The scientific plan for the surface reverberation component of the ARSRP has placed special emphasis on low gazing angle backscatter and high wind speed conditions in the 15-30 kt region. An experiment plan proposing the collection of a high-quality, well-documented data set evolved out of extensive discussions. Although seafloor scattered wavefields have been studied previously, many of the seafloor characteristics important to their understanding had not been measured concurrently. Scattering may vary spatially in the ocean due to variations in seafloor roughness, sediment cover, and water depth. The scientific plan for the bottom reverberation component of the ARSRP has placed special emphasis obtaining a detailed description of the bottom in the natural laboratory where acoustic experiments are to be conducted. The natural laboratory will provide a setting where adequate environmental control is available to understand the connection between seafloor characteristics and scattering characteristics. GRA

N92-20828# Naval Postgraduate School, Monterey, CA.
TIME DOMAIN MODEL BEAMFORMING FOR A NEAR VERTICAL ACOUSTIC ARRAY M.S. Thesis
Steven E. Crocker Dec. 1991 96 p
(AD-A245272) Avail: NTIS HC/MF A05 CSCL 17/1

Ocean acoustic tomography permits the mapping of various properties of a body of water through indirect means. The technique utilizes travel time variations for an acoustic signal to determine the structure of the ocean medium via inverse mathematical methods. The scale of any tomography experiment is fundamentally limited by the signal to noise ratio at the receiver. Through the use of a near vertical acoustic array, normal mode modeling of the local environment and a modal beamformer, array gains are possible which greatly extend the maximum separation between source and receiver. Additionally, the technique provides temporal resolution of the modal components of the arriving signal. A time domain modal beamformer for a near vertical acoustic array has been developed. It has realized a nominal array gain of 6 dB for the Heard Island Experiment vertical array deployed off California. The primary obstacle to the technique remains inadequate array geometry description. GRA

N92-20891# Naval Ocean Systems Center, San Diego, CA.
WAVELET PREPROCESSING OF ACOUSTIC SIGNALS
W. Y. Huang and M. R. Solorzano Dec. 1991 7 p
(AD-A244888) Avail: NTIS HC/MF A02 CSCL 17/1

This paper describes results using the wavelet transform to preprocess acoustic broadband signals in a system that discriminates between different classes of acoustic bursts. This is motivated by the similarity between the proportional bandwidth filters provided by the wavelet transform and those found in biological hearing systems. The experiment involves comparing statistical pattern classifier effects of wavelet and FFT preprocessed acoustic signals. The data used was from the DARPA Phase 1 database, which consists of artificially generated signals with real ocean background. The results show that the wavelet transform did provide improved performance when classifying in a frame-by-frame basis. The DARPA Phase 1 database is well matched to proportional bandwidth filtering; i.e., signal classes that contain high frequencies do tend to have shorter duration in this database. It is also noted that the decreasing background levels at high frequencies compensate for the poor match of the wavelet transform for long duration (high frequency) signals. GRA

N92-21016# Colorado School of Mines, Golden. Dept. of Mathematics and Computer Sciences.
ROUGH SURFACE SCATTERING Final Report, 1 Oct. 1989 - 30 Sep. 1991
John A. DeSanto 25 Nov. 1991 9 p
(Contract N00014-90-J-1038)
(AD-A244829) Avail: NTIS HC/MF A02 CSCL 20/1

The objective is to understand the theory of acoustic scattering from rough surfaces, with applications to ocean surfaces. It is necessary to develop multiple scattering models that are able to treat larger values of roughness, as well as to incorporate as much information as possible into a statistical description of the surface. The mathematical methods we have developed are generic in the sense that they can also be applied to any rough surface. Enhanced backscattering can result when the surfaces are very rough. We have found additional new results for the coherent (specular) intensity and the backscatter enhancement effect for the direct scattering problem. In addition, we have reconstructed surface profiles from scattered field data using two different approaches. GRA

72 ATOMIC AND MOLECULAR PHYSICS

Includes atomic structure, electron properties, and molecular spectra.

N92-20060# Joint Inst. for Lab. Astrophysics, Boulder, CO.
SPECTROSCOPIC DIAGNOSTICS OF ELECTRON-ATOM COLLISIONS
A. Gallagher 1991 22 p
(Contract DE-FG02-87ER-13720)
(DE92-006708; DOE/ER-13720/4) Avail: NTIS HC/MF A03

Progress from May 1, 1987 to April 30, 1991 is summarized in two Progress Reports that are reproduced in Appendix A, and in attached publications. Since then, we have completed manuscript preparations and publications of earlier observations, while carrying out a high energy-resolution measurement of electron collisional excitations in sodium. The results of the latter experiment have not been prepared for publication, and the manuscript is included as Appendix B. An additional manuscript, describing the unique high-current electron monochromator developed for this experiment, is in preparation and not enclosed. All additional results and conclusions of our work under the contract are now available in four publications that are attached at the back of this report. Consequently, we will elaborate on those only to note that we have achieved our proposed goals, with the full detail proposed but at a slightly slower pace than we had hoped. DOE

N92-20067# Argonne National Lab., IL.
TESTING PROTON SPIN MODELS WITH POLARIZED BEAMS
G. P. Ramsey (Loyola Univ., Chicago, IL.) 25 Nov. 1991 11 p Presented at the 4th Workshop on High Energy Spin Physics, Protvino (USSR), 3 Sep. 1991
(Contract W-31-109-eng-38)
(DE92-005233; ANL-HEP-CP-91-93; CONF-9109331-1) Avail: NTIS HC/MF A03

We review models for spin-weighted parton distributions in a proton. Sum rules involving the nonsinglet components of the structure function xg(sub 1)(sup p) help narrow the range of parameters in these models. The contribution of the gamma sub 5 anomaly term depends on the size of the integrated polarized gluon distribution and experimental predictions depend on its size. We have proposed three models for the polarized gluon distributions, whose range is considerable. These model distributions give an overall range is considerable. These model distributions give an overall range of parameters that can be tested with polarized beam experiments. These are discussed with regard to specific predictions for polarized beam experiments at energies typical of UNK. DOE

N92-20102# Argonne National Lab., IL.
STATE-TO-STATE COLLISION DYNAMICS OF MOLECULAR FREE RADICALS
R. G. Macdonald and K. Liu 1992 7 p Presented at the Society of Photo-Optical Instrumentation Engineers' International Symposium on Laser Spectroscopy as Part of SPIE's Symposium on Optics, Electro-Optics and Laser Applications in Science and Engineering, Los Angeles, CA
(Contract W-31-109-eng-38)
(DE92-006990; ANL/CP-73598; CONF-920124-6) Avail: NTIS HC/MF A02

State-to-state collision dynamics of molecular radicals were investigated by the laser-induced fluorescence technique in a pulsed, crossed-beam apparatus. Dramatically different product state distributions were observed for two prototypical radicals, NCO(tilde X sup 2 product) and CH(X sup 2 product). Based on a quantum scattering formalism and general considerations of the potential energy surfaces these observations were interpreted as generic features for the inelastic scattering of (sup 2 product) radicals. The differences observed for NCO and CH are the results of well known Hund's coupling classification of linear molecules. DOE

N92-20134# California Univ., San Diego.
STUDIES IN THEORETICAL PARTICLE PHYSICS
D. B. Kaplan 1 Jul. 1991 18 p
(Contract DE-FG03-90ER-40546)
(DE92-007024; UCSD-916905) Avail: NTIS HC/MF A03

This proposal focuses on research on three distinct areas of particle physics: (1) Nonperturbative QCD. I tend to continue work on analytic modelling of nonperturbative effects in the strong interactions. I have been investigating the theoretical connection between the nonrelativistic quark model and QCD. The primary motivation has been to understand the experimental observation of nonzero matrix elements involving current strange quarks in ordinary matter, which in the quark model has no strange quark component. This has led to my present work on understanding constituent (quark model) quarks as collective excitations of QCD degrees of freedom. (2) Weak Scale Baryogenesis. A continuation of work on baryogenesis in the early universe from weak interactions. In particular, an investigation of baryogenesis occurring during the weak phase transition through anomalous baryon violating processes in the standard model of weak interactions. (3) Flavor and Compositeness. Further investigation of a new mechanism that I recently discovered for dynamical mass generation for fermions, which naturally leads to a family hierarchy structure. A discussion of recent past work is found in the next section, followed by an outline of the proposed research. A recent publication from each of these three areas is attached to this proposal. DOE

N92-20135# California Univ., San Diego.
THEORETICAL PARTICLE PHYSICS, TASK A
1 Jul. 1991 54 p
(Contract DE-FG03-90ER-40546)
(DE92-007123; UCSD-916904) Avail: NTIS HC/MF A04

This report briefly discusses the following topics: The Spin Structure of the Nucleon; Solitons and Discrete Symmetries; Baryon Chiral Perturbation Theory; Constituent Quarks as Collective Excitations; Kaon Condensation; Limits on Neutrino Masses; The 17 KeV Neutrino and Majoron Models; The Strong CP Problem; Renormalization of the CP Violating (Theta) Parameter; Weak Scale Baryogenesis; Chiral Charge in Finite Temperature QED; The Heavy Higgs Mass Bound; The Heavy Top Quark Bound; The Heavy Top Quark Condensate; The Heavy Top Quark Vacuum Instability; Phase Diagram of the Lattice Higgs-Yukawa Model; Anomalies and the Standard Model on the Lattice; Constraint Effective Potential in a Finite Box; Resonance Picture in a Finite Box; Fractal Dimension of Critical Clusters; Goldstone Bosons at Finite Temperature; Cluster Algorithms and Scaling in CP(N) Models; Rare Decay Modes of the Z(degrees) Vector Boson; Parity-Odd Spin-Dependent Structure Functions; Radiative Corrections, Top Mass and LEP Data; Supersymmetric Model with the Higgs as a Lepton; Chiral Change Oscillation in the Schwinger Model; Electric Dipole Moment of the Neutron; DOE Grand Challenge Program; and Lattice Quantum Electrodynamics. DOE

N92-20174# Technische Univ., Berlin (Germany, F.R.). Fachbereich Physik.
EVALUATION OF CONTINUUM RESONANCE IN ATOMIC AND MOLECULAR PHOTOIONIZATION, USING ANGULAR RESOLVED PHOTOELECTRON SPECTROSCOPY Ph.D. Thesis [UNTERSUCHUNG VON KONTINUUMSRESONANZEN IN DER ATOMAREN UND MOLEKULAREN PHOTOIONISATION MITTELS WINKELAUFGELOESTER PHOTOELEKTRONENSPEKTROSKOPIE]
Hans-Georg Kerkhoff 1991 206 p In GERMAN
(ETN-92-91152) Avail: NTIS HC/MF A10

The determination of a number of partial crossections and their angular distribution asymmetry parameters in the field of giant resonances for the baryon, samarium and europium elements, showed that, for increasing effective atomic number, there is no abrupt changeover from a form of resonance to a giant resonance. Before a hybrid type is existent, the sequence of rare Earth can be described. ESA

N92-20206# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
MAGNETIC MOMENTS OF QUADRUPOLE STATES OF EVEN TIN ISOTOPES
A. I. Vdovin, V. Yu. Ponomarev, and R. R. Safarov (Academy of Sciences of the Uzbek SSR, Tashkent.) 1990 15 p In RUSSIAN; ENGLISH summary Submitted for publication
(DE92-600632; JINR-R-4-90-226) Avail: NTIS HC/MF A03

Magnetic dipole moments mu(2(sub i,sup +)) of the 2(sub 1,2,sup +)-states of even-even isotopes Sn-112 to 124 are studied in the framework of the quasiparticle-phonon nuclear model. The mixing of one- and two-phonon components is taken into account in the model wave function of excited states. To describe the influence of the magnetic polarization on mu(2(sub i,sup +)), we include the high-lying (E(sub x) approximately 7-10 MeV) 1(sup +)-states which have large B(M1)-values (M1-resonance) into the two-phonon part of the wave function. Magnetic polarization is rather important for the description of the magnetic moments of the first 2(sup +)-states. Its influence on the mu(2(sub 2,sup +)) is weak. The theoretical results are in qualitative agreement with experimental data on mu(2(sub 1,sup +)) from one isotope to other. DOE

N92-20219# Oak Ridge National Lab., TN.
TRANSVERSE AND FORWARD ENERGY MEASUREMENTS IN NUCLEUS-NUCLEUS COLLISIONS AT 60 AND 200 GeV/NUCLEON
1991 11 p Presented at the Hadron Structure 1991, Stara Lesna (Czechoslovakia), 16-20 Sep. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005161; CONF-9109330-1) Avail: NTIS HC/MF A03

The aim of the high energy heavy ion programs at the SPS and AGS accelerators is to study nuclear matter under conditions of extremely high densities and temperatures. Theoretical calculations predict that under such conditions hadronic matter might undergo a phase transition to a new form of matter, the quark-gluon plasma or QGP, in which quarks and gluons are deconfined over an extended volume. A broad spectrum of possible signatures has been suggested. An unfortunate common characteristic of most of these signatures is the necessity to distinguish them from the background created by ordinary hadronic processes. A thorough understanding of the reaction mechanisms in high energy heavy ion collisions is, therefore, an important prerequisite in any QGP search. Global event quantities like the transverse energy E(sub T), the forward energy E(sub F), and the charged particle multiplicity have proven to be valuable tools for obtaining this understanding of the reaction mechanisms. In this contribution to the Hadron Structure 1991 Conference, results are presented concerning the transverse energy and forward energy extracted from WA80's calorimeters in a series of measurements using beams of O-16 and S-32 bombarding nuclear targets. DOE

N92-20246# Rutherford Appleton Lab., Chilton (England).
TOP SEARCHES AND R-PARITY VIOLATION AT HADRON COLLIDERS
H. Dreiner (Oxford Univ., England) and R. J. N. Phillips Jul. 1991 29 p
(RAL-91-045; OUTP-91-24P; ETN-92-90756) Avail: NTIS HC/MF A03

In R-parity (Rp) violating supersymmetric theories, there are new body top quark decays which can substantially suppress the branching fraction of the Standard Model (SM) process t to bW(+) to bL(+)(sub epsilon 1). With some choices of the dominant Rp violating operator, the CDF top quark mass bound can be lowered below the LEP (Large Electron Positron collider) bound. With other choices, however, leptonic signals from top decay become much stronger; in such scenarios the bounds on the top quark mass become more stringent than the S bounds. In future top quark searches, Rp violating decays could lead to the most prominent signals. ESA

N92-20258# Akron Univ., OH.
DYNAMICS OF CHARGE-TRANSFER EXCITED STATES RELEVANT TO PHOTOCHEMICAL ENERGY CONVERSION
E. C. Lim Nov. 1991 11 p
(Contract DE-FG02-89ER-14024)
(DE92-005301; DOE/ER-14024/3) Avail: NTIS HC/MF A03

The primary objective of the research program is to gain a fundamental understanding of the factors governing the efficiency of excited-state charge transfer (CT) interactions between two chromophores that are brought together in close proximity, either by a very short covalent linkage or by ground-state complex formation. CT and van der Walls (vdW) interactions in covalently bonded bichromophoric compounds in condensed phase, as well as those in vdW complexes in supersonic jets, are being investigated using laser-based techniques in a variety of experimental conditions. This progress report is divided into three parts, according to the class of molecular systems and the phase (liquid vs. gas) in which the excited-state interactions are probed. The first is concerned with the excited states of bridged diaryl compounds in the condensed phase. The second involves the excited states of vdW complexes in supersonic jets. Finally, the third is concerned with the excited states of electron donor-acceptor (EDA) systems in both the condensed phase and supersonic jets. In each of these studies, we are concerned with the interchromophore interactions ranging from weak vdW forces to strong CT forces, and the factors determining whether the interaction forces are weak or strong in related molecules. DOE

N92-20309# Oak Ridge National Lab., TN.
COLLECTIVE PROPERTIES AND SHAPES OF NUCLEI AT VERY HIGH SPINS
Noah R. Johnson 1991 10 p Presented at the International School cf Nuclear Physics on 4Pi High Resolution Gamma-ray, Erice (Italy), 20-28 Sep. 1991
(Contracts DE-AC05-84OR-21400; DE-FG05-88ER-40407; DE-FG05-87ER-40361)
(DE92-005414; CONF-9109332-1) Avail: NTIS HC/MF A02

A topic which has been of major interest to us for some years now involves the evolution of nuclear collectivity at high rotational frequencies and the accompanying changes in the shapes of nuclei in these extreme conditions. We carry out these studies by determining the dynamic electromagnetic multipole moments which are a reflection of the collective aspects of the nuclear wave functions. The most direct way to get these multipole moments is by measurements of excited-state lifetimes which provide the transition matrix elements in a fairly straightforward fashion. Although the primary emphasis of this paper is on the collectivity of the high spin states in Yb-160 and Yb-164, it is important to review briefly some work we began about ten years ago lifetime studies of moderately high spins in nuclei near N = 90 using the recoil-distance (RD) method. These nuclei are just at the onset of permanent deformation and are known to be very soft with respect to deformation changes. This softness is clearly illustrated in contour diagrams of their potential-energy surfaces. For example, the potential energy surface of Yb-160 reveals that the minimum in the potential occurs around (var epsilon) approx. = 0.2 and that it is very shallow in the gamma degree of freedom. Because of their gamma softness, we have studied several nuclei near N = 90 to assess to what extent the polarization effects induced by rotation alignment of high-j quasiparticles affect their collectivity. DOE

N92-20310# Oak Ridge National Lab., TN.
EARLY MEASUREMENTS OF DIELECTRONIC RECOMBINATION OF MULTIPLY CHARGED IONS
P. F. Dittner and S. Datz 1991 9 p Presented at the NATO Workshop on Recombination of Atomic Ions, Belfast (Ireland), 6-9 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005422; CONF-9110313-3) Avail: NTIS HC/MF A02

Quite early in the mid-70s, it had become apparent that data on recombination of multiply charged ions was urgently needed for accurate modelling of fusion plasmas and coincidentally to

test theories of dielectronic recombination which were beginning to develop at that time. The question of which techniques to apply to obtain the required data is asked. Multicharged ion sources were not highly developed. Moreover, since a signature of recombination is stabilized charged capture, and since capture cross sections from background gas are enormous at low velocities, we chose not to use low energy multicharged ions. The approach of the Oak Ridge group was to use high velocity multicharged ion beams, merged with a high density compressed spaced charge limited electron beam. The advantages are that (1) multicharged ions are easily produced at high velocities obtained from, e.g., Tandem Van de Graaff accelerators, (2) charge transfer cross sections on background gas for multicharged ions are induced by approx. 3 orders of magnitude at MeV/nucleon energies compared to keV/nucleon energies, and (3) higher ion velocities require higher energy electron beams and, hence, higher space charge limited currents and electron target densities. DOE

N92-20349# Argonne National Lab., IL.
THE MEASUREMENT OF GAMMA RAY INDUCED HEATING IN A MIXED NEUTRON AND GAMMA RAY ENVIRONMENT
H. K. Chiu Oct. 1991 166 p
(Contract W-31-109-eng-38)
(DE92-006457; ANL/FPP/TM-257) Avail: NTIS HC/MF A08

The problem of measuring the gamma heating in a mixed DT neutron and gamma ray environment was explored. A new detector technique was developed to make this measurement. Gamma heating measurements were made in a low-Z assembly irradiated with 14-Mev neutrons and (n, n(prime)) gammas produced by a Texas Nuclear Model 9400 neutron generator. Heating measurements were made in the mid-line of the lattice using a proportional counter operating in the Continuously-varied Bias-voltage Acquisition mode. The neutron-induced signal was separated from the gamma-induced signal by exploiting the signal rise-time differences inherent to radiations of different linear energy transfer coefficient, which are observable in a proportional counter. The operating limits of this measurement technique were explored by varying the counter position in the low-Z lattice, hence changing the irradiation spectrum observed. The experiment was modelled numerically to help interpret the measured results. The transport of neutrons and gamma rays in the assembly was modelled using the one-dimensional radiation transport code ANISN/PC. The cross-section set used for these calculations was derived from the ENDF/B-V library using the code MC(exp 2)-2 for the case of DT neutrons slowing down in a low-Z material. The calculated neutron and gamma spectra in the slab and the relevant mass-stopping powers were used to construct weighting factors which relate the energy deposition in the counter fill-gas to that in the counter wall and in the surrounding material. The gamma energy deposition at various positions in the lattice is estimated by applying these weighting factors to the measured gamma energy deposition in the counter at those locations. DOE

N92-20421# Los Alamos National Lab., NM.
NUCLEAR EFFECTS ON HEAVY QUARK PRODUCTION: RESULTS FROM FERMILAB EXPERIMENTS E772 AND E789
1991 12 p Presented at the Quark Matter '91, Gatlinburg, TN, 11-15 Nov. 1991
(Contract W-7405-eng-36)
(DE92-005067; LA-UR-91-3962; CONF-9111165-1) Avail: NTIS HC/MF A03

Fermilab Experiments E772 and E789 are fixed target experiments with 800 GeV protons incident on nuclear targets corresponding to a center-of-mass energy of square root of s approx. = 39 GeV. Measurements are made with a pair spectrometer which has a solid angle of a few percent and operates at high luminosity with up to approx. 10(exp 12)(E772) or approx. 10(exp 11)(E789) protons/spill. Our experimental program explores several types of nuclear medium effects: the modification of quark and gluon structure functions by the nucleus, effects on the production of vector mesons (e.g. J/psi and gamma), and effects on the production of D mesons. The latter is accomplished with the use of a new silicon vertex detector. E789 also looks at the decays of B mesons including the decay to J/psi and searches for the decays to two-charged particles (e.g. B yields h(+)h(-)) but I will not discuss this part of our program in this paper. DOE

N92-20530# New Hampshire Univ., Durham.
ELECTROMAGNETIC STUDIES OF NUCLEAR STRUCTURE AND REACTIONS
1991 14 p
(Contract DE-FG02-88ER-40410)
(DE92-005088; DOE/ER-40410/3) Avail: NTIS HC/MF A03

The past year has seen continued progress in our efforts. On the experimental side, we completed data acquisition on our major remaining involvement at NIKHEF, the C-12 (electron-electron pair production) experiment. We advanced the analysis of most of projects in low lying nuclear structure and giant resonances, of which several were completed and published. We received approval for several new experiments, and have made major contributions to design and development of detectors to be used at Bates and CEBAF. Our data interpretation efforts have been extended and enhanced with the availability of our new computer cluster. In this paper we briefly report on most of these efforts. DOE

N92-20550# Oak Ridge National Lab., TN.
ON-LINE NUCLEAR ORIENTATION OF As-70
J. K. Deng, J. H. Hamilton, A. V. Ramayya, W. C. Ma, X. W. Zhao, J. Kormicki, N. Severijns, L. Vanneste (Louvain Univ., Belgium), and W. D. Hamilton 1991 7 p Presented at the Working Group 3 Joint Coordinating Committee on Nuclear Reactor Safety (JCCNRS) Meeting, Oak Ridge, TN, 16-18 Oct. 1991 Prepared in cooperation with Vanderbilt Univ., Nashville, TN
(Contracts DE-AC05-84OR-21400; DE-FG05-88ER-40407; DE-AC05-76OR-00033; DE-FG05-87ER-40361)
(DE92-005119; CONF-9110236-4) Avail: NTIS HC/MF A02

On line nuclear orientation was performed on As-70. Anisotropy data have been obtained at 8.7 mK for 29 gamma transitions. Multipole mixing ratios have been extracted for 17 transitions. Our results are in good agreement with existing data for the ten previously measured transitions. Our first time data for the 1496 keV, 2+ yields 2+ gamma ray suggest the 2526 keV level is a good candidate for a mixed symmetry level. DOE

N92-20552# Oak Ridge National Lab., TN.
NUMERICAL IMPLEMENTATION OF THE DIRAC EQUATION ON HYPERCUBE MULTICOMPUTERS
J. C. Wells, A. S. Umar, and V. E. Oberacker (Vanderbilt Univ., Nashville, TN.) 1991 31 p Presented at the International Supercomputer Users Group Meeting, Dallas, TX, 7-9 Oct. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005128; CONF-9110317-1) Avail: NTIS HC/MF A03

Motivated by an interest in nonperturbative electromagnetic lepton-pair production in relativistic heavy-ion collisions, we discuss the numerical methods used in implementing a lattice solution of the time-dependent Dirac equation in three-dimensional Cartesian coordinates. Discretization is obtained using the lattice basis-spline collocation method, in which quantum-state vectors and coordinate-space operators are expressed in terms of basis-spline functions, and represented on a spatial lattice. All numerical procedures reduce to a series of matrix-vector operations which we perform on the Intel iPSC/860 hypercube multicomputer. We discuss solutions to the problems of limited node memory and node-to-node communication overhead inherent in using distributed-memory, multiple-instruction, multiple-data parallel computers. DOE

N92-20554# Los Alamos National Lab., NM.
PION ELASTIC AND INELASTIC SCATTERING FROM N-15 Ph.D. Thesis
D. P. Saunders Dec. 1991 165 p
(Contract W-7405-eng-36)
(DE92-005435; LA-12183-T) Avail: NTIS HC/MF A08

Data were obtained on the Clinton P. Anderson Los Alamos Meson Physics Facility Energetic Pion Channel and Spectrometer for elastic and inelastic pion scattering from ground state N-15

nuclei. States observed here included those of 0.0, 5.27, 6.32, 7.16, 7.30, 7.57, 8.31, 8.57, 9.15, 9.76, 9.9, 10.7, 11.3, 11.9, 12.5, 12.9, 13.1, 14.1, 14.4, 14.6, 15.0, 16.5, 16.9, 17.2, 17.6, 18.3, 18.7, and 18.9 MeV excitation energies. Angular distributions were obtained for scattering at angles from 25 degrees 90 degrees in 5 degree increments with an incident pion energy of 164 MeV. Optical model analyses of the elastic (0 MeV) angular distributions with equal point proton and neutron densities in both momentum and coordinate space formulations accurately predict the data, although the two formulations require different energy shifts to do so. This difference is thought to be a result of the more accurate nonlocal representation of the nuclear potential in the momentum space code. Additional spectra were obtained for scattering at constant momentum transfers of .94 and 1.57 fm(exp -1) in order to generate constant momentum transfer excitation functions. Use of these excitation functions, sigma pi (exp +)/sigma pi (sup minus) ratios, and shell model DWIA calculations allowed identification of several excited states having shell-model-like, single particle-hole, pure spin-flip excitations. Shell model and collective model DWIA calculations, as well as the q = .94 and 1.57 fm(exp minus 1) excitation functions and the sigma pi (exp +)/sigma pi (exp minus) ratios indicate that the other states are generally well represented by a shell model description with collective enhancements. DOE

N92-20565# Brookhaven National Lab., Upton, NY.
A SILICON MULTIPLICITY DETECTOR SYSTEM FOR AN EXPERIMENT ON THE INTERACTION OF ANTIPROTONS WITH NUCLEI AT BNL
S. Ahmad, B. E. Bonner, J. A. Buchanan, J. M. Clement, A. Empl, G. S. Mutchler, S. Toshkov (Rice Univ., Houston, TX.), S. E. Eiseman, A. Etkin, and K. J. Foley et al 1991 5 p Presented at the IEEE Nuclear Science Symposium, Santa Fe, NM, 5-9 Nov. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005389; BNL-46978; CONF-911106-60) Avail: NTIS HC/MF A01

A Large Angle Multiplicity Detector (LAMD) system was developed at Brookhaven National Lab (BNL). The LAMD was used in conjunction with BNL experiment E854: Antiproton Nucleus Interactions. This system performed well with an energetic antiproton beam. Charged particle multiplicity distributions from pbar annihilations were measured. The design and performance of the LAMD system is discussed in this paper. DOE

N92-20845# Science Applications International Corp., Ottawa (Ontario).
NUCLEAR SURVIVABILITY OF NON-DEVELOPMENTAL EQUIPMENT Final Report
1990 48 p Sponsored by Defence Research Establishment
(CTN-92-60423) Avail: NTIS HC/MF A03

This study focuses on methodology for applying transient radiation effects on electronics (TREE) hardening to an existing electronic subsystem that was not originally designed to withstand the effects of nuclear radiation. A radio set, AN/PRC-77, was selected as the candidate for analysis. The effects of transient ionizing radiation, neutrons, and total ionizing dose were evaluated, and recommendations for mitigating deleterious effects are provided. These consist of identification of components requiring replacement, addition of current limiting where required, and implementation of power switching. The results of the study indicated that an acceptable degree of radiation hardness can be achieved for the radio set at modest cost. This assessment technique is adaptable to other types of electronic hardware.
CISTI

N92-20877# Science Applications International Corp., Ottawa (Ontario).
DEVELOPMENT OF A NEW VERSION OF THE VEHICLE PROTECTION FACTOR CODE (VPF3) Final Report
Terrance J. Jamieson 22 Oct. 1990 65 p Sponsored by Defence Research Establishment
(SAIC-89-03; CTN-92-60422) Avail: NTIS HC/MF A04

The Vehicle Protection Factor (VPF) Code is an engineering tool for estimating radiation protection afforded by armoured vehicles and other structures exposed to neutron and gamma ray radiation from fission, thermonuclear, and fusion sources. A number of suggestions for modifications have been offered by users of early versions of the code. These include: implementing some of the more advanced features of the air transport rating code, ATR5, used to perform the air over ground radiation transport analyses; allowing the ability to study specific vehicle orientations within the free field; implementing an adjoint transport scheme to reduce the number of transport runs required; investigating the possibility of accelerating the transport scheme; and upgrading the computer automated design (CAD) package used by VPF. The generation of radiation free field fluences for infinite air geometries as required for aircraft analysis can be accomplished by using ATR with the air over ground correction factors disabled. Analysis of the effects of fallout bearing debris clouds on aircraft will require additional modelling of VPF. CISTI

N92-20885# Princeton Univ., NJ. Dept. of Chemistry.
OPTIMALLY DESIGNED FIELDS FOR CONTROLLING MOLECULAR DYNAMICS Final Report, Jul. 1988 - Jun. 1991
Herschel Rabitz 1 Oct. 1991 10 p
(Contract DAAL03-88-K-0101)
(AD-A244723; ARO-25673.10-CH) Avail: NTIS HC/MF A02
CSCL 20/5

This research concerns the development of molecular control theory techniques for designing optical fields capable of manipulating molecular dynamic phenomena. Although is has been long recognized that lasers should be capable of manipulating dynamic events, many frustrating years of intuitively driven laboratory studies only serve to illustrate the point that the task is complex and defies intuition. The principal new component in the present research is the recognition that this problem falls into the category of control theory and its inherent complexities require the use of modern control theory tools largely developed in the engineering disciplines. Thus, the research has initiated a transfer of the control theory concepts to the molecular scale. Although much contained effort will be needed to fully develop these concepts, the research in this grant set forth the basic components of the theory and carried out illustrative studies involving the design of optical fields capable of controlling rotational, vibrational and electronic degrees of freedom. Optimal control within the quantum mechanical molecular realm represents a frontier area with many possible ultimate applications. At this stage, the theoretical tools need to be joined with merging laboratory optical pulse shaping capabilities to illustrate the power of the concepts. GRA

N92-20914# Sandia National Labs., Albuquerque, NM.
PHOTOPHYSICS AND PHOTOCHEMISTRY OF SINGLET OXYGEN IN MACROMOLECULAR MATRICES
R. L. Clough, V. L. Taylor, M. P. Dillion, M. Kristiansen, and P. R. Ogilby 1991 6 p Presented at the American Chemical Society National Meeting, San Francisco, CA, 5-10 Apr. 1992
(Contract DE-AC04-76DP-00789)
(DE92-003955; SAND-91-2729C; CONF-920444-4) Avail: NTIS HC/MF A02

We are studying the kinetics of singlet oxygen ((sup 1)Delta(sub g)O2) in solid polymers by monitoring its phosphorescence in time-resolved experiments. In macromolecular matrices where (sup 1)Delta(sub g)O2 is produced by energy transfer from a photosensitizer, (sup 1)Delta(sub g)O2 lifetimes can be obtained by deconvoluting the (sup 1)Delta(sub g)O2 sensitizer kinetics from the (sup 1)Delta(sub g)O2 phosphorescence signal. The sensitizer kinetics can be obtained in a flash absorption experiment. These time-resolved techniques have been utilized to examine the interaction of (sup 1)Delta(sub g)O2 in polymers with two types of additives: (1) molecules capable of undergoing chemical reactions with (sup 1)Delta(sub g)O2 (reactive quenchers), and (2) molecules capable of quenching (sup 1)Delta(sub g)O2 to its ground triplet state (physical quenchers). From this study we have determined directly that significant reactive and physical quenching of (sup 1)Delta(sub g)O2 are possible in a solid polymer. The polymer matrix greatly reduces the quenching rate of a very efficient

quencher and slightly elevates the quenching rate of inefficient quenchers, as compared with rates determined in analogous liquids. This compressed range of quenching efficiencies has implications for understanding photodegradation and stabilization of polymers. DOE

N92-20943# Bubble Technology Industries, Inc., Chalk River (Ontario).
FURTHER DEVELOPMENT OF A SET OF LOW SENSITIVITY DETECTORS FOR THE MEASUREMENT OF NUCLEAR RADIATION FOR APPLICATION IN TRANSIENT RADIATION EFFECTS ON ELECTRONICS (TREE) RESEARCH Final Report
K. Tremblay, T. Clifford, S. Mason, W. Webb, R. A. Noulty, and H. Ing Mar. 1991 116 p Sponsored by Defence Research Establishment
(BTI-91/3-25; CTN-92-60417) Avail: NTIS HC/MF A06

A miniaturized version of the neutron bubble spectrometer capable of measuring high neutron doses (approx. 100 rads) is being developed for the requirements of the Transient Radiation Effects on Electronics (TREE) program. Four specific detectors having neutron energy thresholds of 10, 100, 1000, and 2500 keV have been prepared. These detectors are capable of measuring neutron spectral information at small localized areas. They have been calibrated and the results of measurements at Aberdeen Proving Ground and Royal Military College (Kingston, Ontario) are given. Also included is an assessment of the method of homogeneous nucleation as a viable approach to the making of miniature droplets and the building of improved Rh foil spectrometer. Recommendations are made regarding additional research needs. CISTI

N92-20990# Lawrence Livermore National Lab., CA.
PARTICLE EMISSION INDUCED BY THE INTERACTION OF HIGHLY CHARGED SLOW Xe-IONS WITH A SiO2 SURFACE
G. Schiwietz, B. Skogvall (Hahn-Meitner-Inst. G.m.b.H., Berlin, Germany, F.R.), D. Schneider, M. Clark, D. DeWitt, and J. McDonald 30 Oct. 1991 6 p Presented at the 12th European Conference on Surface Science, Stockholm (Sweden), 9-12 Sep. 1991
(Contract W-7405-eng-48)
(DE92-007307; UCRL-JC-109057; CONF-910931-3) Avail: NTIS HC/MF A02

Sputtering of surface atoms by low energy (a few keV) heavy ions is a commonly used technique in material science and applied physics. In general, sputtering occurs via nuclear energy transfer processes and is determined mainly by the atom-atom interaction potentials. In the energy range of interest, these potentials depend only slightly on the charge state of one collision partner if the other is neutral. The development of new ion-sources, however, allows for the use of ions with charged states of q greater than 50. For these highly charged ions it is conceivable that electronic processes come into play as well. If, for example, the density of charged surface atoms exceeds a certain limit, then particle emission can occur via the electrostatic repulsion of target atoms, the so-called Coulomb explosion. Indications for such electronic effects have been found in a few investigations of ion-induced sputtering Si (q less than 12 in Ar(q+)). However, the order of magnitude of this effect was not clear until now. In this work, we present preliminary data on sputtering, ion backscattering, and electron and photon emission from SiO2 surface induced by incident Xe ions of very high charge states (q=30 to 50). The experiment was performed at the electron beam ion trap (EBIT) of the Lawrence Livermore National Laboratory using a time-of-flight (TOF) ion analyzer-system from the Hahn-Meitner-Institute, Berlin. DOE

N92-21053# California Univ., Los Angeles. Dept. of Physics.
PARTICLE PHYSICS
Oct. 1991 4 p
(Contract DE-FG03-88ER-40420)
(DE92-003471; DOE/ER-40420/T1) Avail: NTIS HC/MF A01

This report discusses: rare and forbidden decays of eta and mu to test the standard model; tests of charge symmetry and isospin invariance; studies of baryon resonances: (pi)N scattering, inverse pion photoproduction, eta-meson photoproduction, and the production of the eta meson in pi(sup -) p yields eta n; and exploratory investigations in support of the new programs and under consideration. DOE

N92-21054# Argonne National Lab., IL.
ENERGY UP-CONVERSION AND TRAPPING: DYNAMICS OF 5f STATES OF Bk(4+) IN CeF4
G. K. Liu and J. V. Beitz 1991 15 p
(Contract W-31-109-eng-38)
(DE92-003547; ANL/PP-70969) Avail: NTIS HC/MF A03

Energy transfer mechanisms of excited 5f states of Bk(sup 4+) (0.05 atom percent) in CeF4 containing circa 0.95 atom percent Cf(sup 4+) have been investigated at 4 K. The observed anti-Stokes fluorescence arises from both up-conversion and two-photon excitation. Nonexponential decays of Stokes fluorescence are ascribed to both excitation-excitation annihilation and site-dependent trapping processes and, therefore, are not describable by the Inokuti-Hirayama or exciton annihilation models. Based on the Forster-Dexter energy transfer theory, a new model is developed to fit the observed fluorescence decay data. DOE

N92-21064# Oak Ridge National Lab., TN.
ENERGY FUNCTIONALS FOR INHOMOGENEOUS MANY-ELECTRON SYSTEMS
D. J. W. Geldart (Dalhousie Univ., Halifax, Nova Scotia) and M. Rasolt Oct. 1991 48 p Presented at the Gordon Godfrey Workshop on Condensed Matter Physics: Strongly Correlated Electron Systems, Sydney (Australia), 1-5 Jul. 1991
(Contract DE-AC05-84OR-21400)
(DE92-003566; CONF-910795-2) Avail: NTIS HC/MF A03

The primary purpose of these lectures is to provide a pedagogical introduction to Density Functional Theory (DFT). We begin with the very early picture of Thomas and Fermi for the ground state energy of a neutral atom and proceed to the highly successful method of Kohn and Sham (KS) which focuses attention on the exchange-correlation contribution E(sub XC)(n) to the energy functional. We stress the importance of a systematic approach to the study of the subtle nonlocal structure of E(sub XC)(n) in inhomogeneous systems. The local and global convergence properties of gradient expansions are examined in some detail for both density and low density systems. The structure of E(sub XC)(n) in the low density regime is described. Aspects of energy functionals which are determined by global symmetries and boundary conditions (in contrast to largely local energetics) are illustrated by the examples of the structure factor in bounded geometry and band gap discontinuities in semiconductors. An illustrative application of DFT is made to the problem of instabilities of the strongly correlated low density electron liquid with respect to charge modulated ground states. DOE

73 NUCLEAR AND HIGH-ENERGY PHYSICS

Includes elementary and nuclear particles; and reactor theory.

For space radiation see *93 Space Radiation.*

N92-20082# Argonne National Lab., IL.
RECENT DEVELOPMENTS IN THE APPLICATION OF RF SUPERCONDUCTIVITY TO HIGH-BRIGHTNESS AND HIGH-GRADIENT ION BEAM ACCELERATORS
J. R. Delayen, C. L. Bohn, W. L. Kennedy, G. L. Nichols, C. T. Roche, and L. Sagalovsky 1991 18 p Presented at the 5th RF Superconductivity Workshop at DESY, Hamburg (Germany), 19-21 Aug. 1991
(Contract W-31-109-eng-38)
(DE92-005221; ANL/CP-74899; CONF-9108189-1) Avail: NTIS HC/MF A03

A development program is underway to apply RF superconductivity to the design of continuous-wave (CW) linear

accelerators for high brightness ion beams. Since the last workshop, considerable progress has been made both experimentally and theoretically toward this application. Recent tests of niobium resonators for ion acceleration have yielded average accelerating gradients as high as 18 MV/m. In an experiment with a radio frequency quadrupole geometry, niobium was found to sustain CW peak surface electric fields as high as 128 MV/m over large (10 sq cm) surface areas. Theoretical studies of beam impingement and cumulative beam breakup have also yielded encouraging results. Consequently, a section of superconducting resonators and focusing elements has been designed for tests with high current deuteron beams. In addition, considerable data pertaining to the RF properties of high (Tc) superconductors has been collected at RF field amplitudes and frequencies of interest in connection with accelerator operation. This paper summarizes the recent progress and identifies current and future work in the areas of accelerator technology and superconducting materials which will build upon it. DOE

N92-20162# Oesterreichisches Forschungszentrum Seibersdorf G.m.b.H., Vienna. Engineering Energie- und Anlagentechnik.
SOURCE TERM CALCULATIONS FOR THE VVER-1000 TYPE REACTOR [QUELLTERMRECHNUNGEN FUER DEN WWER-1000 REAKTOR]
Gert Sdouz Apr. 1991 57 p In GERMAN; ENGLISH summary
(OEFZS-4575; ETN-92-90644) Copyright Avail: NTIS HC/MF A04

The calculation is performed, using the Source Term Code Package (STCP). The selected accident sequence is a small break in the hot leg followed by loss of offsite and onsite electric power. The results are presented and analyzed for each program in connection with the subject of the calculation. All release fractions are inferior to 0.0001. ESA

N92-20345# Duke Univ., Durham, NC. Dept. of Physics.
HIGH ENERGY PHYSICS
L. R. Fortney, A. T. Goshaw, and W. D. Walker 12 Jun. 1991 21 p
(Contract DE-AS05-76ER-03065)
(DE92-007354; DOE/ER-03065/T10) Avail: NTIS HC/MF A03

This report discusses the following research: Search for a Quark-Gluon Plasma; CDF Research; Research at the SSC (SDC); SSC Tracking Detector R&D; Studies of Direct Photons, Charmonium; Study of Beauty Production; Research at the SSC (SFT); Particle-nucleus Collsions; Hadronic Charm Particle Production; Photo of Mesons; Computers; and, Detector R&D Laboratory. DOE

N92-20578# Brookhaven National Lab., Upton, NY.
CONSTRUCTION AND COMMISSIONING OF THE AGS BOOSTER ULTRA-HIGH VACUUM SYSTEM
H. C. Hseuh, M. Mapes, B. Shen, and R. Sikora 1991 22 p Presented at the 38th National Symposium of the American Vacuum Society, Seattle, WA, 11-15 Nov. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005386; BNL-46920; CONF-911132-12) Avail: NTIS HC/MF A03

The recently completed AGS Booster is a synchrotron for the acceleration of protons and heavy ions. To minimize the beam loss due to charge exchange of the partially stripped, low beta (= v/c), very heavy ions with the residual gas molecules, ultra high vacuum of 10(exp -11) Torr is required for the 200 m Booster ring. An average pressure of mid 10(exp -11) Torr has been achieved and maintained after initial insitu bakes and commissioning. In this paper we describe the following: (1) design and layout of the vacuum systems; (2) material selection and vacuum processing; (3) PC/PLC based bakeout system; (4) operation of vacuum instrumentation over long cable length; (5) results of bakeout and evaluation; and (6) experience gained during construction and commissioning. DOE

N92-20972# Fermi National Accelerator Lab., Batavia, IL.
THE PHYSICS OF PROTON-ANTIPROTON COLLISIONS
M. Shochet (Chicago Univ., IL.) 3 Dec. 1991 107 p Presented at the Particles in the 1990s, Les Houches (France), 30 Jun. - 26 Jul. 1991
(Contract DE-AC02-76CH-03000)
(DE92-007202; FNAL/C-91/341-E; CONF-9106329-1) Avail: NTIS HC/MF A06

This paper contains information on accelerator and detector; QCD studies; studies of the electroweak force; the search for the top quark; (beta) physics at hadron colliders; and the search for exotic objects, and prospects for the future. DOE

N92-20974# Lawrence Livermore National Lab., CA.
DESIGN CONSIDERATIONS FOR LONG-PULSE, HIGH-REPETITION-RATE MODULATORS FOR RECIRCULATING HEAVY-ION ACCELERATORS
M. A. Newton, L. L. Reginato, and S. S. Yu Jun. 1991 5 p Presented at the 8th IEEE Pulsed Power Conference, San Diego, CA, 17-19 Jun. 1991
(Contract W-7405-eng-48)
(DE92-007332; UCRL-JC-105651; CONF-910640-48) Avail: NTIS HC/MF A01

Heavy-ion accelerators are considered to be one of the promising driver alternatives for inertial fusion. In an inertial fusion driver, multiple beams of heavy-ions are accelerated to kinetic energies consistent with the fusion target requirements. During acceleration, the beams of heavy ions are compressed in time from an initial pulse duration that ranges from 10's to 100's of microseconds to a final pulse duration of approximately 10 nanoseconds. The compressed beam of heavy ions is then focused on the target in a reactor chamber where the energy released from the fusion reaction is converted to thermal energy and eventually to electricity. A recirculator is an induction accelerator which accelerates the particles and bends them in a closed path with pulsed dipole magnets. A single beam traverses the same accelerating cavities many times (50-100) to acquire its final energy. The primary motivation to evaluate recirculators is the potential for low cost that results from re-using many of the most expensive accelerator components, such as the induction cells, pulsers, and focusing magnets, during an acceleration sequence. One of the areas of technology that is critical to the feasibility of a recirculator is the modulator system required to accelerate the ion beams. This system greatly impacts the overall design of the recirculating accelerator. System studies have been conducted to evaluate the cost and efficiency of several recirculator configurations as a function of various parameters. These system studies have helped identify desirable induction cell driver characteristics. These characteristics and the trade-offs that were evaluated will be presented and discussed. DOE

N92-20998# Oak Ridge National Lab., TN.
ANALYSIS OF THE FALL-1989 TWO-METER BOX TEST BED EXPERIMENTS PERFORMED AT THE ARMY PULSE RADIATION FACILITY (APRF)
J. O. Johnson, J. D. Drischler, and J. M. Barnes 1991 5 p Proposed for presentation at the Meeting on New Horizons in Radiation Protection and Shielding, Pasco, WA, 26 Apr. - 1 May 1992
(Contract DE-AC05-84OR-21400)
(DE91-018178; CONF-920431-1) Avail: NTIS HC/MF A01

This report summarizes the results of a benchmark analysis of the Monte Carlo Adjoint Shielding Code System (MASH) against a series of experiments performed at the Army Pulse Radiation Facility (APRF) in Aberdeen Proving Ground, Maryland. The series of experiments was performed in the Fall of 1989 and involved experimentalists from APRF; the Defense Research Establishment Ottawa, Canada (DREO); Bubble Technology Industries, Canada, (BTI); and the Establishment Technique Central de l'Armement, France (ETCA). The 'benchmark' analysis of MASH is designed to determine the capability of MASH to reproduce the measured neutron and gamma ray integral and differential (spectral) data. Results of the 'benchmark' analysis are to be used in the

recommendations to the North Atlantic Treaty Organization (NATO) Panel 7 Ad Hoc Group of Shielding Experts for replacing the Vehicle Code System (VCS) with MASH as the reference code of choice for armored vehicle nuclear vulnerability calculations. DOE

N92-21036# Westinghouse Hanford Co., Richland, WA.
MODIFICATION OF HOT CELLS FOR GENERAL PURPOSE HEAT SOURCE ASSEMBLY AT THE RADIOISOTOPE POWER SYSTEMS FACILITY
B. A. Carteret Sep. 1991 10 p Presented at the 9th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 13-16 Jan. 1992 Revised
(Contract DE-AC06-87RL-10930)
(DE92-001807; WHC-SA-1259-Rev-1; CONF-920104-4-Rev-1)
Avail: NTIS HC/MF A02

Eight existing, unused hot cells currently are being modified for use in the Radioisotope Power Systems Facility (RPSF) to assemble Pu-238 fueled heat sources for radioisotope thermoelectric generators (RTGs). Four air atmosphere cells will be used for storage, decanning, and decontamination of the iridium-clad radioisotope fuel. The remaining four argon atmosphere cells will be used to assemble fuel and graphite components for production and packaging of general purpose heat source (GPHS) assembly modules, which provide heat to drive the thermoelectric conversion process in the generators. The hot cells will be equipped to perform remote and glovebox-type operations. They will provide shielding and contamination control measures to reduce worker radiation exposure to levels within current U.S. Department of Energy (DOE) guidelines. Designs emphasize the Westinghouse Hanford Company (Westinghouse Hanford) as low as reasonably achievable (ALARA) radiation protection policy. DOE

N92-21038# Los Alamos National Lab., NM.
STARTUP AND CONTROL OF OUT-OF-CORE THERMIONIC SPACE REACTORS
M. G. Houts and D. D. Lanning (Massachusetts Inst. of Tech., Cambridge.) 1991 13 p Presented at the 9th Symposium on Space Nuclear Power Systems, Albuquerque, NM, 13-16 Jan. 1992
(Contracts W-7405-eng-36; DE-FG07-90ER-12930)
(DE92-002301; LA-UR-91-3200; CONF-920104-14) Avail: NTIS HC/MF A03

An analysis of out-of-core thermionic space reactor (OTR) startup and control has been performed. The reference ionic thermal reactor (ITR) chosen for this study is a 75 kWt version of the STAR-C (GA Technologies 1987). The applicability of point kinetics was first verified for the reference OTR system. Point kinetics applicability was verified for core length-to-diameter (L/D) ratios of two and four, and for both subcritical-to-critical and critical-to-supercritical transients. A coupled thermal/point kinetics code was then written, and OTR startup was analyzed. The analyses lead to several observations. First, point kinetics is applicable to the reference OTR for all transients considered. Second, to achieve a 900 second startup the reference OTR must operate at powers well above steady-state rated power during startup. Finaily, the large thermal inertia of the radial reflector could be used to reduce radiator temperature during the first several hundred seconds of operation. Further research should be performed on transient heat pipe operation and on off-normal thermionic converter operation. DOE

N92-21041# General Atomic Co., San Diego, CA.
FUNDAMENTAL AND SECOND HARMONIC HYDROGEN FAST-WAVE HEATING ON D3-D
C. C. Petty, R. I. Pinsker, M. J. Mayberry, R. Prater, M. Porkolab, P. T. Bonoli (Massachusetts Inst. of Tech., Cambridge.), F. W. Baity, R. H. Goulding, and D. J. Hoffman Oct. 1991 5 p Presented at the 9th Topical Conference on Radio Frequency Power in Plasmas, Charleston, SC, 19-21 Aug. 1991
(Contracts DE-AC03-89ER-51114; DE-AC05-84OR-21400)
(DE92-002949; GA-A-20693; CONF-910869-25) Avail: NTIS HC/MF A01

Ion cyclotron resonance heating (ICRH) with fast waves has been investigated on D3-D in both the fundamental hydrogen minority (32 MHz, 2.14 K) and second harmonic hydrogen majority (60 MHz, 1.97 K) regimes. The main purpose of these experiments was to characterize the fast wave coupling and propagation in preparation for upcoming fast wave current drive (FWCD) experiments. For the fundamental minority regime, the electron and ion heating, global confinement, and radiated power fraction are compared for ICRH and neutral beam injection (NBI) discharges with P(sub aux) approx. = 1 MW. The ICRH experiments were conducted using a four strap antenna which was designed for current drive experiments. The antenna is fed by a single 2 MW 30-60 MHz transmitter. For ICRH experiments, either (0,0,0,0) or (0,pi,0,pi) phasing was used. The launched parallel index of refraction for (0,pi,0,pi) phasing is the absolute value of n(parallel) approx. = 21 at 32 MHz, and the absolute value of n(parallel) approx. = 11 at 60 MHz. DOE

74 OPTICS

Includes light phenomena; and optical devices.
For lasers see *36 Lasers and Masers.*

N92-20128# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
EXPERIENCE OF USING TWO-DIRECTED LINK IN ONE FIBER OPTICS CABLE
A. E. Afanasev, M. V. Bojko, and B. Ya. Gerasimov 1990 4 p In RUSSIAN; ENGLISH summary
(DE92-607360; IFVE-OEA-90-67) Avail: NTIS HC/MF A01

Experimental two-directed fiber-optics link (FOL) at the wavelength of (lambda) = 0.85 mkm with the use of Y-type couplers is described. The poduction technique of these couplers is presented. Using such FOL is studied for the tevatron where the distance between data exchange devices may reach 1-2 km. DOE

N92-20296# Brookhaven National Lab., Upton, NY.
FIGURE AND FINISH CHARACTERIZATION OF HIGH PERFORMANCE METAL MIRRORS
P. Z. Takacs and E. L. Church Oct. 1991 9 p Presented at the American Society for Precision Engineering (ASPE) Conference, Tucson, AZ, 15-18 Apr. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005023; BNL-45882; CONF-9104206-7) Avail: NTIS HC/MF A02

Most metal mirrors currently used in synchrotron radiation (SR) beam lines to reflect soft x rays are made of electroless nickel plate on an aluminum substrate. This material combination has allowed optical designers to incorporate exotic cylindrical aspheres into grazing incidence x ray beam handling systems by taking advantage of single point diamond machining techniques. But the promise of high quality electroless nickel surfaces has generally exceeded the performance. We will examine the evolution of electroless nickel surfaces through a study of the quality of mirrors delivered for use at the National Synchrotron Light Source over the past seven years. We have developed techniques to assess surface quality based on the measurement of surface roughness and figure errors with optical profiling instruments. It is instructive to see how the quality of the surface is related to the complexity of the machine operations required to produce it. DOE

N92-20394# National Inst. of Standards and Technology, Gaithersburg, MD.
ANALYSIS OF OPTICAL FLOW ESTIMATION USING EPIPOLAR PLANE IMAGES
R. Rangachar, T. H. Hong, M. Herman, and R. Luck Apr. 1991 14 p Prepared in cooperation with American Univ., Washington, DC; Maryland Univ., College Park; and Aspex, Inc., New York, NY
(PB92-112564; NISTIR-4569) Avail: NTIS HC/MF A03 CSCL 20F

Image flow, the apparent motion of brightness patterns on the

image plane, can provide important visual information such as distance, shape, surface orientation, and boundaries. It can be determined by either feature tracking or spatial temporal analysis. The spatio-temporal methods are considered and it is shown how differential range can be estimated from time-space imagery. A time-space image can be generated by considering only one scan line of the image obtained from a camera moving in the horizontal direction at each time interval. At the next instant of time, the previous line is shifted up by one pixel, and another line is obtained from the image. Each feature along the horizontal scan line generates an edge in the time-space image, the slope of which depends on the distance of the feature from the camera. Two mutually perpendicular edge operators are applied to the time-space image, and the slope of each image is determined. It is shown that this corresponds to optical flow. The results are used to obtain the differential range, and this is implemented on the Pipelined Image Processing Engine (PIPE). Provided is a statistical analysis of the results of 3-D reconstruction of the scenes using optical flow determined from the edge operators. Author

N92-20697# Naval Ocean Systems Center, San Diego, CA.
OCEANIC APPLICATIONS OF FIBER OPTICS
M. R. Brininstool Dec. 1991 26 p
(AD-A244887) Avail: NTIS HC/MF A03 CSCL 20/6

Oceanic applications of fiber optics are rapidly advancing, following on the heels of the more mature land-based telecommunication systems. While many features of each arena are similar, undersea fiber systems demand unique capabilities. Components capable of withstanding brutal hydrostatic pressures and near freezing temperatures had to be developed. This paper highlights undersea fiber optic systems and their features. It focuses on long distance telecommunications and remotely-operated vehicle (ROV) links. Also addressed is the emerging technology of fiber optic sensors. These designs use the fiber as a sensing element to detect such variables as displacement, pressure, temperature, strain, and rotation. Author (GRA)

N92-20706# SRI International Corp., Menlo Park, CA.
HIGH-SPEED, HIGH-DENSITY, COHERENT TIME DOMAIN OPTICAL MEMORY Annual Report
R. Kachru and X-A. Shen Nov. 1991 40 p
(Contract F49620-90-C-0083)
(AD-A244845; AFOSR-91-1008TR) Avail: NTIS HC/MF A03 CSCL 20/6

Our goal is to quantitatively evaluate the concept of time-domain optical memory (TDOM) based on the stimulated photon echo technique and to prepare for the development of a working prototype. Earlier feasibility studies at SRI International showed that TDOM can store not only digital data in the form a series of on-off laser pulses but also two-dimensional (2-D) images with the same read/write speed. Despite work at SRI and elsewhere, until now the use of TDOM for 2-D images has not been carefully examined and the quality of echo images and their inherent spatial resolution have not been explored. These issues have an important bearing on TDOM as a high-speed, high-density storage device. This year, we focused on using the stimulated echo technique for 2-D image storage and image processing. Specific tasks included incorporating a gated intensified charge-coupled device (CCD) camera system for detecting echo images, digitally recording the echo images, and optimizing the optical system. We have also extended the earlier feasibility study on stimulated-echo-based, 2-D image storage and image processing and demonstrated storage and retrieval of the high-quality, high-resolution echo images. In addition, we demonstrated for the first time that nanosecond pattern recognition can be achieved using the stimulated echo approach.
Author (GRA)

N92-20810# Pennsylvania Univ., Philadelphia. Dept. of Physics.
MOLECULAR OPTICS NONLINEAR OPTICAL PROCESSES IN ORGANIC AND POLYMERIC CRYSTALS AND FILMS, PART 1 Final Report, 15 Jul. 1990 - 14 Jan. 1991
A. F. Garito Nov. 1991 288 p
(Contract F49620-88-C-0127; ARPA Order 4989)
(AD-A244898; AFOSR-91-1015-Vol-1TR) Avail: NTIS HC/MF A13 CSCL 20/6

Optical bistability is a quantum optical realization of a first order phase transition far from equilibrium. A nonlinear optical material contained in an optical cavity driven resonantly by an external coherent optical field undergoes a first order phase transition to a new nonequilibrium stationary state of broken symmetry. Resonant and nonresonant nonlinear optical response of pi-electron excitations in conjugated electronic structure provides the nonlinearity essential to the onset of bistability. Electronic correlation effects in reduced dimensions are responsible for nonresonant nonlinear optical responses. Saturable absorption studies of glassy polymer films consisting of quasi-two dimensional conjugated disc-like structure of silicon naphthalocyanine demonstrate that, on-resonance, the system behaves as an optical Bloch system with an intensity dependent refractive index of 10 to the -4 power sq cm per kilowatt. Based on the results of these studies, electronic absorptive optical bistability is observed on a nanosecond time scale in a nonlinear Fabry-Perot interferometer employing the saturable absorbing silicon naphathalocyanine film as the nonlinear optical medium. GRA

N92-20811# Pennsylvania Univ., Philadelphia. Dept. of Physics.
MOLECULAR OPTICS NONLINEAR OPTICAL PROCESSES IN ORGANIC AND POLYMERIC CRYSTALS AND FILMS, PART 2 Final Report, 15 Jul. 1990 - 14 Jan. 1991
A. F. Garito Nov. 1991 259 p
(Contract F49620-88-C-0127; ARPA Order 4989)
(AD-A244899; AFOSR-91-1015-Pt-2TR) Avail: NTIS HC/MF A12 CSCL 20/6

Comprehensive theoretical and experimental studies of the magnitude, sign, dispersion, and length dependence of the third order molecular susceptibility gamma ijkl(-omega 4; omega 1, omega 2, omega 3) demonstrate that the microscopic origin of the nonresonant third order nonlinear optical properties of conjugated linear chains is determined by the effects of electron correlation due to electron-electron repulsion. Multiple-excited configuration interaction calculations of gamma jkl(-omega 4; omega 1, omega 2, omega 3) for the archetypal class of quasi-one dimensional conjugated structures known as polyenes reveal for the first time the principal role of strongly correlated, energetically high-lying, two photon 1 Ag virtual states in the largest of the two dominant, competing virtual excitation processes that determine gamma ijkl(-omega 4; omega 1, omega 2, omega 3). It is also found in studies of the effects of conformation on gamma ijkl(-omega 4; omega 1, omega 2, omega 3) that the origin of the third order optical properties remains basically the same for the all-trans and cis-transoid polyenes, and the results for the two conformations are unified by a common power law dependence of the dominant tensor component gamma xxxx(-omega 4; omega 1, omega 2, omega 3) on the physical end-to-end length L of the chain with an exponent of 3.5. GRA

N92-20830# Department of the Navy, Washington, DC.
FABRICATION AND PHASE TUNING OF AN OPTICAL WAVEGUIDE DEVICE Patent Application
William K. Burns, inventor (to Navy), Catherine H. Bulmer, inventor (to Navy), and Arthur S. Greenblatt, inventor (to Navy) 27 Sep. 1991 16 p
(AD-D015179; US-Patent-Appl-SN-766939) Avail: NTIS HC/MF A03 CSCL 20/6

The manufacture of an optical waveguide device utilizing a fast, accurate method for tuning of the output phase angle of such devices to a desired operating point. Tuning is accomplished by adjusting the accumulated phase along a waveguide arm of the device by removing optical waveguide material using laser ablation. Due to the change in waveguide geometry in the ablated region, the optical phase velocity is changed and thus the optical path length is affected in that section of waveguide, thereby resulting in a change in output phase angle. Author (GRA)

N92-20963# Naval Ocean Systems Center, San Diego, CA.
VALIDATION OF THE BULK METHOD FOR OVERWATER OPTICAL REFRACTIVITY Final Report, Oct. 1990 - Sep. 1991
R. A. Paulus Oct. 1991 39 p
(AD-A245029; NOSC-TR-1462) Avail: NTIS HC/MF A03
CSCL 04/1

The effects of refraction on optical propagation at low altitudes over the ocean were investigated. A telescope was used to optically track ships to the range at which they disappeared over the horizon. Concurrent bulk meteorological measurements were used with surface-layer theory to model optical refractivity. A ray-trace program, with these profiles of refractivity, was used to calculate maximum intervision range (MIVR). Calculated MIVRs agree well with observations for subrefractive conditions (air cooler than water) typical of the open ocean. Agreement is not as good for super-refractive and ducting conditions (air warmer than water), which occurred with offshore flow and are therefore not typical of open ocean. Optical ducting conditions also appear to vary with range, such that point meteorological measurements and homogeneous ray tracing are not representative. GRA

N92-21030# Lawrence Livermore National Lab., CA.
MULTILAYER COATINGS ON FIGURED OPTICS
S. P. Vernon, D. G. Stearns, R. S. Rosen, N. M. Ceglio, D. P. Gaines, M. Krumrey, and P. Mueller (Physikalisch-Technische Bundesanstalt, Berlin, Germany, F.R.) Jul. 1991 10 p Presented at the Society of Photo-Optical Instrumentation Engineers (SPIE) Meeting, San Diego, CA, 21-26 Jul. 1991
(Contract W-7405-eng-48)
(DE92-007340; UCRL-JC-108298; CONF-9107115-68) Avail: NTIS HC/MF A02

Soft x-ray projection lithography (SXPL) will require uniform, high reflectivity multilayer (ML) coatings on figured optical surfaces with lens speeds (f(sup (number sign))) between 3 and 6 and diameters of 10 to 15 cm. High reflectivity Mo-Si ML coatings for operation near 13 nm were deposited on f(sup (number sign))3.4 and f(sup (number sign))6 optics 5 and 7.5 cm in diameter using planar DC magnetron sputtering. Measurements of the normal incidence reflectivity (NIR) of 63 percent at 13 nm uniform over the central 5 cm of the figured surface were obtained. Comparison of the measured values to model calculations of the wavelength dependent reflectivity indicate that the ML period is uniform to better than 0.04 nm over this region. DOE

75 PLASMA PHYSICS

Includes magnetohydrodynamics and plasma fusion.
For ionospheric plasmas see *46 Geophysics*. For space plasmas see *90 Astrophysics*.

N92-20083# General Atomic Co., San Diego, CA.
AN ADVANCED PLASMA CONTROL SYSTEM FOR THE D3-D TOKAMAK
J. R. Ferron, A. Kellman, E. McKee, T. Osborne, P. Petrach, T. S. Taylor, J. Wight, and E. Lazarus (Oak Ridge National Lab., TN.) Nov. 1991 4 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contracts DE-AC03-89ER-51114; DE-AC05-84OR-21400)
(DE92-005439; GA-A-20641; CONF-910968-57) Avail: NTIS HC/MF A01

An advanced plasma control system is being implemented for the DIII-D tokamak utilizing digital technology. This system will regulate the position and shape of tokamak discharges that range from elongated limiter to single-null divertor and double-null divertor with elongation as high as 2.6. Development of this system is expected to lead to control system technology appropriate for use on future tokamaks such as ITER and BPX. The digital system will allow for increased precision in shape control through real time adjustment of the control algorithm to make changes in the shape and discharge parameters such as Beta(sub p), l(sub i), and the scrape-off layer current. The system is designed for research on real time optimization of discharge performance for disruption avoidance, current and pressure profile control, optimization of RF antenna loading, and feedback on heat deposition patterns through divertor strike point position control. Shape control with this system is based on linearization near a target shape of the controlled parameters as a function of the magnetic diagnostic signals. This digital system is unique in that it is designed to have the speed necessary to control the unstable vertical motion of highly elongated tokamak discharges such as those produced in DIII-D and planned for BPX and ITER. A 40 MHz Intel i860 processor is capable of interfacing with up to 112 channels of analog input signals. The commands to the poloidal field coils can be updated at 80 microsecond intervals for the control of vertical position with a delay between sampling of the analog signal and update of the command of less than 80 microseconds. DOE

N92-20085# Sandia National Labs., Albuquerque, NM.
HYDROGEN IN DIELECTRIC FILM FORMATION FROM AN ELECTRON CYCLOTRON RESONANCE PLASMA
J. C. Barbour and H. J. Stein 1991 6 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC04-76DP-00789)
(DE92-005461; SAND-91-1425C; CONF-911202-32) Avail: NTIS HC/MF A02

The incorporation of hydrogen into silicon nitride films grown downstream from an electron cyclotron resonance (ECR) plasma decreased rapidly with increasing substrate temperature (100 to 600 C). Fourier transform infrared (FTIR) spectroscopy showed that the hydrogen in the as-grown material was primarily bonded to nitrogen. However, an applied bias of -200 V caused an increase in the number of Si-H bonds relative to N-H bonds, as a result of increased ion-beam damage. In addition, ion irradiation of an as-grown film with 175 keV Ar(+) at room temperature showed that H transferred from N-H bonds to Si-H bonds without a loss of H. Elastic recoil detection (ERD) and FTIR of thermally annealed films showed that the stability of H incorporated during deposition increased with deposition temperature, and that the N-H bond was more stable than Si-H bond above 700 C. Deuterium plasma treatments, at 600 C, of annealed films caused isotopic substitution with a conservation of bonds. Therefore, hydrogen loss from annealed films is apparently accompanied by a reduction in dangling bonds. DOE

N92-20115# General Atomic Co., San Diego, CA.
THE 3D FOKKER-PLANCK CALCULATION OF COMBINED FAST WAVE/LOWER HYBRID AND ELECTRON CYCLOTRON CURRENT DRIVE IN TOKAMAKS
R. W. Harvey, S. C. Chiu, M. G. McCoy, G. D. Kerbel, G. R. Smith, and T. K. Mau Dec. 1991 13 p Presented at the IAEA Technical Committee Meeting on Fast Wave Current Drive in Reactor Scale Tokamaks, Arles (France), 23-25 Sep. 1991
(Contracts DE-AC03-89ER-51114; W-7405-eng-48; DE-FG03-86ER-52126)
(DE92-005485; GA-A-20752; CONF-9109333-1) Avail: NTIS HC/MF A03

In a non-reactor tokamak environment, lower hybrid current drive can be combined with electron cyclotron waves, both (1) to control the radial profile of LH current deposition, and (2) to enhance the current drive efficiency. A related RF synergy is the use of multiple LH spectra for radial profile control as demonstrated in the ASDEX tokamak. In a reactor environment, fast waves provide an appropriate primary current drive system which can penetrate radially to the plasma core, and can be combined with ECCD. We use the CQL3D Fokker-Planck code to study these processes. Modelings of LHCD radial profile control by 'filling the spectral gap' with EC or with additional LH power are presented. In the reactor environment, a range of cases with combined fast wave and electron cyclotron waves are examined, but no useful synergisms are found. DOE

N92-20241 Miami Univ., Coral Gables, FL.
TWO-DIMENSIONAL TIME-DEPENDENT MAGNETO-HYDRODYNAMIC SIMULATIONS OF ACCELERATING ARC PLASMAS Ph.D. Thesis
George Christopher Boynton 1991 132 p
Avail: Univ. Microfilms Order No. DA9201116

An investigation of the internal dynamics of accelerated arc plasmas including instabilities of the Kruskal-Schwarzchild type. The accelerated arc plasmas are in the regime of plasma armatures typical in electromagnetic rail launchers with current densities on the order of 10(exp 8) amps/sq m, accelerations on the order of 10(exp 7) m/s(exp 2), and temperatures on the order of 10(exp 4) Kelvin. A numerical 2-dimensional magnetohydrodynamic (MHD) model is used to study the plasma armature in contact with a near vacuum magnetic field. The nonlinear bubble, spike, and other surface deformations are followed using a hybrid flux corrected transport (FCT) code. A description of the resulting disruption of the main plasma arc is sought. This disruption together with rail ablation can lead to secondary arcs and other loss mechanisms. Dissert. Abstr.

N92-20302# General Atomic Co., San Diego, CA.
THE D3-D TOKAMAK TROUBLE REPORT DATABASE
P. I. Petersen and S. M. Miller Nov. 1991 3 p Presented at the 14th IEEE Symposium on Fusion Engineering, San Diego, CA, 30 Sep. - 3 Oct. 1991
(Contract DE-AC03-89ER-51114)
(DE92-005395; GA-A-20612; CONF-910968-63) Avail: NTIS HC/MF A01

Operation of the DIII-D tokamak at General Atomics involves many groups which work on the various subsystems. To overview and speed the solution to trouble or problem areas that limit machine availability, a common trouble report system was established. The TROUBLE database automates the recording of trouble reports and eases analysis of problem areas. It contains information on equipment affected, description of problem, cause of problem, solution to problem, and machine downtime (if any). It was created using S1032 from Compuserve Data Technologies and runs on a VAX 8650. The data is used to find the major problem areas so they can be solved and improve the tokamak availability. The data is available to Idaho National Engineering Laboratory (INEL). They are using the data with data from other tokamaks to develop a Fusion Failure Experience Data Collection. Our experience is that a few failures are often the cause of a major part of the downtime. We will discuss these failures and the actions taken to correct them. The data base also will be used to determine the preventive maintenance schedule for different components. DOE

N92-20346# Montana State Univ., Bozeman. Dept. of Mechanical Engineering.
CORROSION AND ARC EROSION IN MHD CHANNELS
R. J. Rosa and R. J. Pollina Oct. 1991 4 p
(Contract DE-FG22-88PC-88928)
(DE92-005201; DOE/PC-88928/T7) Avail: NTIS HC/MF A01

The objective of this task is to study the corrosion and arc erosion of MHD materials in a cooperative effort with, and to support, the MHD topping cycle program. Materials tested in the Avco Research Laboratory/Textron facility, or materials which have significant MHD importance, will be analyzed to document their physical deterioration. Conclusions shall be drawn about their wear mechanisms and lifetime in the MHD environment with respect to the following issues; sulfur corrosion, electrochemical corrosion, and arc erosion. The impact of any materials or slag conditions on the level of power output and on the level of leakage current in the MHD channel will also be noted, where appropriate. DOE

N92-20406# MSE, Inc., Butte, MT.
MAGNETOHYDRODYNAMIC PROJECTS AT THE CDIF
1991 12 p
(Contract DE-AC07-88ID-12735)
(DE92-005297; DOE/ID-12735/T20) Avail: NTIS HC/MF A03

The Component Development and Integration Facility (CDIF) is a major U.S. Department of Energy magnetohydrodynamic (MHD) test facility in Butte, Montana. Within the national MHD program, personnel are responsible for performing integration testing of vendor-supplied MHD power train components at the CDIF to support the goal of commercialization. During the fourth quarter of FY91, MHD testing was shut down. In addition to installing the new Data Acquisition System (DAS), activities such as rebuilding the channel, investigating and repairing the magnet leak, installing the slag removal system, and modifying existing systems were addressed. DOE

N92-20581# California Univ., Los Angeles. Inst. of Plasma and Fusion Research.
PLASMA-MATERIALS INTERACTIONS AND EDGE-PLASMA PHYSICS RESEARCH
Y. Hirooka, ed. Dec. 1991 62 p
(Contract DE-FG03-86ER-52134)
(DE92-006426; UCLA-PPG-1380) Avail: NTIS HC/MF A04

The Pisces program and its facilities are described. Additionally, the following areas of research, performed in support of the Pisces program, are discussed: edge plasma physics; edge plasma behavior; and materials and surface physics. DOE

N92-20892# Naval Research Lab., Washington, DC.
SPECTROSCOPIC STUDY OF NEON Z-PINCH PLASMA FOR SODIUM-NEON PHOTOPUMPING EXPERIMENTS Ph.D. Thesis
Benjamin L. Welch 6 Jan. 1992 284 p
(AD-A244643; NRL-MR-6930) Avail: NTIS HC/MF A13 CSCL 20/9

Spectroscopic measurements were made of neon Z-pinch plasmas to establish conditions appropriate for sodium-neon photopumping. Emissions of soft X-rays, extreme ultraviolet (XUV), and near ultraviolet (NUV) were measured. Plasma electron temperatures and densities were determined by comparing measurements with steady-state and time-dependent atomic-physics models. Dependences of plasma emissions on the magnitude and risetime of the current and on the initial mass loading were investigated. Peak currents of 120 to 300 kA and 1-micron to 50-ns risetime were used to implode a 1-cm diameter neon gas puff. Mass loadings ranging from 1.2 to 3.6 micrograms/cm were varied by adjusting the gas-puff pressure. Adjustments of the current, current risetime, and mass loading can be used to produce an appropriate neon plasma for sodium-neon photopumping. GRA

N92-20976# Lawrence Livermore National Lab., CA.
A REVIEW OF SPECTRAL LINE BROADENING RELEVANT TO HOT DENSE PLASMAS
R. W. Lee 22 Aug. 1991 21 p Presented at the AIP Conference, Portland, ME, 23 Aug. 1991
(Contract W-7405-eng-48)
(DE92-007347; UCRL-JC-108219; CONF-9108195-1) Avail: NTIS HC/MF A03

A review of the recent work performed in the study of spectral line broadening in dense plasmas is presented. The work reviewed will cover recent advances in the theoretical development of line broadening and touch only briefly on the experimental aspects of the problem. Efforts to develop line shape calculations appropriate for spectral synthesis, which can be used in the study of opacities and non-LTE radiative transfer, will also be discussed. A brief summary of the currently available resources for line shapes will be presented. A bibliography of the papers used in the review is provided. DOE

N92-21025# International Centre for Theoretical Physics, Trieste (Italy).
NONLINEAR INTERACTION OF WAVES AT THE INPUT OF A BEAM INTO A SEMI-BOUNDED WARM PLASMA
A. M. Hussein Jul. 1991 7 p
(DE92-614466; IC-91/182) Avail: NTIS HC/MF A02

An investigation is made of the nonlinear interaction of waves at the input of a beam into a semi-bounded warm plasma. The amplitudes of the wave have been found. The effect of the thermal

velocity is to increase the amplitude of the generated waves. The absorption of the energy of these waves by the plasma can exceed the energy at the expense of waves with the basic frequency.
DOE

N92-21046# California Univ., Berkeley.
EXPERIMENTAL STUDIES OF COMPACT TOROIDS
1991 11 p
(Contract DE-FG03-87ER-53262)
(DE92-003469; DOE/ER-53262/T2) Avail: NTIS HC/MF A03

The Berkeley Compact Toroid Experiment (BCTX) device is a plasma device with a Marshall-gun generated, low aspect ratio toroidal plasma. The device is capable of producing spheromak-type discharges and may, with some modification, produce low-aspect ratio tokamak configurations. A unique aspect of this experimental device is its large lower hybrid (LH) heating system, which consists of two 450 MHz klystron tubes generating 20 megawatts each into a brambilla-type launching structure. Successful operation with one klystron at virtually full power (18 MW) has been accomplished with 110 microsecond pulse length. A second klystron is currently installed in its socket and magnet but has not been added to the RF drive system. This report describes current activities and accomplishments and describes the anticipated results of next year's activity. DOE

76 SOLID-STATE PHYSICS

Includes superconductivity.

For related information, see also *33 Electronics and Electrical Engineering* and *36 Lasers and Masers.*

N92-20055# Midwest Research Inst., Golden, CO.
POLYCRYSTALLINE THIN-FILM TECHNOLOGY: RECENT PROGRESS IN PHOTOVOLTAICS
R. L. Mitchell, K. Zweibel, and H. S. Ullal Dec. 1991 7 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1991
(Contract DE-AC02-83CH-10093)
(DE92-001195; NREL/TP-214-4589; CONF-920436-16) Avail: NTIS HC/MF A02

Polycrystalline thin films have made significant technical progress in the past year. Three of these materials that have been studied extensively for photovoltaic (PV) power applications are copper indium diselenide (CuInSe2), cadmium telluride (CdTe), and thin film polycrystalline silicon (x-Si) deposited on ceramic substrates. The first of these materials, polycrystalline thin film CuInSe2, has made some rapid advances in terms of high efficiency and long term reliability. For CuInSe2 power modules, a world record has been reported on a 0.4 sq m module with an aperture-area efficiency of 10.4 pct. and a power output of 40.4 W. Additionally, outdoor reliability testing of CuInSe2 modules, under both loaded and open-circuit conditions, has resulted in only minor changes in module performance after more than 1000 days of continuous exposure to natural sunlight. CdTe module research has also resulted in several recent improvements. Module performance has been increased with device areas reaching nearly 900 sq cm. Deposition has been demonstrated by several different techniques, including electrodeposition, spraying, and screen printing. Outdoor reliability testing of CdTe modules was also carried out under both loaded and open-circuit conditions, with more than 600 days of continuous exposure to natural sunlight. These tests were also encouraging and indicated that the modules were stable within measurement error. The highest reported aperture-area module efficiency for CdTe modules is 10 pct.; the semiconductor material was deposited by electrodeposition. A thin-film CdTe photovoltaic system with a power output of 54 W has been deployed in Saudi Arabia for water pumping. The Module Development Initiative has made significant progress in support of the Polycrystalline Thin-Film Program in the past year, and results are presented in this paper. DOE

N92-20081# Argonne National Lab., IL.
RECONSTRUCTION OF A HIGH-ANGLE TWIST GRAIN BOUNDARY BY GRAND-CANONICAL SIMULATED QUENCHING
S. R. Phillpot and J. M. Rickman Nov. 1991 6 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract W-31-109-eng-38)
(DE92-005216; ANL/CP-74996; CONF-911202-35) Avail: NTIS HC/MF A02

A formalism for obtaining the zero-temperature structure of mono- component solids by simulated quenching in the grand-canonical ensemble is outlined. The structure of a high-angle twist grain boundary on the (110) plane of an fcc metal is investigated. The lowest energy structure is found to be a twinned structure with a density approximately 20 percent higher than the structure obtained from canonical-ensemble energy-minimization.
DOE

N92-20084# Sandia National Labs., Albuquerque, NM.
ION IMPLANTATION IN GLASSES: MECHANICAL MODIFICATIONS
G. W. Arnold 1991 14 p Presented at the Fall Meeting of the European Materials Research Society, Strasbourg (France), 5-8 Nov. 1991
(Contract DE-AC04-76DP-00789)
(DE92-005460; SAND-91-1443C; CONF-911109-8) Avail: NTIS HC/MF A03

Implantation into glasses induces surface stresses which affect mechanical properties. These stresses can be conveniently measured by cantilever beam techniques. For fused silica and other simple silicate glasses, the stress for various ions scales with collisional energy deposition. For complex borosilicates, electronic processes are dominant in establishing stress. For fused silica, stress and hardness (and other physical properties) achieve maximum change at about 2(10)(exp 20) keV/cu cm and then decrease. For fused silica and other silicates, a second critical energy deposition is found at approximately 10(exp 23) keV/cu cm above which many properties (including hardness) exhibit changes associated with an extended damage range. Mechanical properties are greatly altered by implant-induced (N,B) compound formation. Crystallization of the implanted layer can also bring about large increases in surface hardness. DOE

N92-20086# Sandia National Labs., Albuquerque, NM.
GROWTH OF BN THIN FILMS BY PULSED LASER DEPOSITION
J. A. Knapp 1991 5 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC04-76DP-00789)
(DE92-005462; SAND-91-1528C; CONF-911202-33) Avail: NTIS HC/MF A01

A new ultra-high vacuum (UHV) chamber for doing Pulsed Laser Deposition of materials is described. Additionally, the results from preliminary experiments of the deposition of BN on Si are reported. The system is designed to allow for in-situ diagnostics of the ablation plasma, as well as UHV preparation and characterization of clean sample substrates. The room temperature depositions of BN result in amorphous, B-rich films, whose particle content is a strong function of laser wavelength. DOE

N92-20091# Los Alamos National Lab., NM.
EFFICIENT DATA TRANSMISSION FROM SILICON WAFER STRIP DETECTORS
B. J. Cooke, K. S. Lackner, A. P. T. Palounek, D. H. Sharp, L. Winter, and H. J. Ziock 1991 7 p Presented at the IEEE Nuclear Science Symposium, Santa Fe, NM, 5-9 Nov. 1991
(Contract W-7405-eng-36)
(DE92-005074; LA-UR-91-3903; CONF-911106-59) Avail: NTIS HC/MF A02

An architecture for on-wafer processing is proposed for central silicon-strip tracker systems as they are currently designed for high energy physics experiments at the SSC, and for heavy ion

experiments at RHIC. The data compression achievable with on-wafer processing would make it possible to transmit all data generated to the outside of the detector system. A set of data which completely describes the state of the wafer for low occupancy events and which contains important statistical information for more complex events can be transmitted immediately. This information could be used in early trigger decisions. Additional data packages which complete the description of the state of the wafer vary in size and are sent through a second channel. By buffering this channel the required bandwidth can be kept far below the peak data rates which occur in rate but interesting events. DOE

N92-20097# Oak Ridge National Lab., TN.
KORRINGA-KOHN-ROSTOKER ELECTRONIC STRUCTURE METHOD FOR SPACE-FILLING CELL POTENTIALS
A. Gonis, W. H. Butler, and X.-G. Zhang (Kentucky Univ., Lexington.) 1991 13 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contracts DE-AC05-84OR-21400; W-7405-eng-48)
(DE92-006596; CONF-911202-39) Avail: NTIS HC/MF A03

The multiple scattering theory (MST) method of Korringa, and of Kohn and Rostoker for determining the electronic structure of solids, originally developed in connection with potentials bounded by non-overlapping spheres (muffin-tin (MT) potentials), is generalized to the case of space-filling potential cells of arbitrary shape through the use of a variational formalism. This generalized version of MST retains the separability of structure and potential characteristic of the application of MST to MT potentials. However, in contrast to the MT case, different forms of MST exhibit different convergence rates for the energy and the wave function. Numerical results are presented which illustrate the differing convergence rates of the variational and nonvariational forms of MST for space-filling potentials. DOE

N92-20124# Oak Ridge National Lab., TN.
EPITAXIAL YBa2Cu3O(7-x) THIN FILMS: SCANNING TUNNELING MICROSCOPE STUDY OF THE INITIAL STAGES OF EPITAXIAL GROWTH, GROWTH MECHANISM, AND EFFECTS OF SUBSTRATE TEMPERATURE
Shen Zhu, X.-Y. Zheng (Tennessee Univ., Knoxville.), D. H. Lowndes, D. P. Norton, and R. J. Warmack 1991 6 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005470; CONF-911202-28) Avail: NTIS HC/MF A02

The surface microstructure of epitaxial YBa2Cu3O(7-x) films, grown by pulsed laser ablation on (001) MgO and SrTiO3 substrates, was studied at various growth stages, ranging in thickness from eight c-axis perpendicular unit cells to approximately 220 nm. On MgO (lattice mismatch is approximately 9 percent) even the thinnest films grow unit cell-by-unit cell by an island growth mechanism. However, on SrTiO3 (mismatch is approximately 1 percent), a transition from a layer-like growth mode to island growth is observed as the film thickness increases. Islands with clear spiral growth structures are observed in even the thinnest films on MgO, but for films grown on SrTiO3 the spiral growth features are found only for film thicknesses slightly greater than the critical thickness for the switch to an island growth mode. The islands consist of stacks of atomically flat terraces whole step heights are multiples of the c-axis lattice parameter. This island density decreases significantly with increasing film thickness, while their diameters range from 50-400 nm, increasing with growth temperature. The terraced island grain morphology causes a surface roughness of from 10 to 30 nm (depending on growth temperature) in films approximately 200 nm thick. DOE

N92-20199# Brookhaven National Lab., Upton, NY.
SILICIDE FORMATION IN HIGH-DOSE Fe-IMPLANTED SILICON
Z. Tan, S. M. Heald, F. Namavar, J. I. Budnick, and F. H. Sanchez (Connecticut Univ., Storrs.) 1991 7 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contracts DE-AC02-76CH-00016; DE-FG02-90ER-45424; DE-AS05-80ER-10742)
(DE92-005376; BNL-46352; CONF-911202-23) Avail: NTIS HC/MF A02

We have studied the silicide formation in Fe-implanted Si(100), with 1 x 10(exp 17) - 1 x 10(exp 18) Fe/sq cm, using extended x ray absorption fine structure (EXAFS), x ray diffraction and Rutherford backscattering spectrometry (RBS) methods. In the samples as-implanted at 350 C, no silicide was observed at doses below 3 x 10(exp 17) Fe/sq cm. At 5 x 10(exp 17), both alpha-FeSi2 and beta-FeSi2 form but alpha-FeSi2 appears to be the majority phase. As the dose increases to 7 x 10(exp 17) and above, ordered FeSi forms, but implantation damage is severe and a large number of Fe atoms are in very disordered environments. In addition to FeSi, Fe5Si3 was also observed in the 1 x 10(exp 18) Fe/sq cm sample. Upon post-implantation annealing at 700 or 900 C, single phase beta-FeSi2 was obtained independent of the dosage. DOE

N92-20201# Oak Ridge National Lab., TN.
HIGH-PRESSURE OF f-ELEMENT MATERIALS
R. G. Haire 1991 15 p Presented at the Joint Metallurgy Society (TMS)-Australasian Institute of Mining and Metallurgy (IMM) Rare Earth Symposium, San Diego, CA, 2-5 Mar. 1992
(Contract DE-AC05-84OR-21400)
(DE92-005112; CONF-920374-1) Avail: NTIS HC/MF A03

Studies of the f-elements under pressure provide important insights into their solid state chemistry and physics. From such studies of the elements and their alloys, it has been established that the normally localized f-electrons of several of these elements can become involved in bonding under pressure. The electronic behavior of f-element compounds under pressure tend to be more difficult to interpret, due to the variety and the nature of electronic orbitals that are present. The 4f-elements and some 60 pct. of the 5f-elements have been studied under pressure. The systematic comparisons that have been established for these materials are discussed. DOE

N92-20216# Brookhaven National Lab., Upton, NY.
SUPERCONDUCTING PROPERTIES, CHEMICAL COMPOSITIONS, AND LATTICE PARAMETERS OF Pb-, Sn, AND (Pb(1-x)Sn(x))Mo6S8
N. Sadakata, R. Corderman, T. Asano, D. Cox, M. Suenaga, S. Foner, and E. J. McNiff, Jr. (Massachusetts Inst. of Tech., Cambridge.) 1991 7 p Presented at the 7th US-Japan Workshop on High-Field Superconductors, Fukuoka (Japan), 21-23 Oct. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005448; BNL-46798; CONF-9110306-2) Avail: NTIS HC/MF A02

The values of critical temperatures for alloys of Pb- and SnMo6S8 were shown to be lower than those of the respective pure Chevrel phases. Chemical compositional analysis of the compounds revealed that the decreased (Tc) in the alloys are due to the off-stoichiometric compositions in the alloys. Although alloying slightly increased the values of the upper critical field H sub c2 over that for PbMo6S8, the H sub c2 values for these specimens were substantially lower than those which have been reported for PbMo6S8. Possible causes for these depressed values of H sub c2 are discussed. DOE

N92-20217# Pacific Northwest Lab., Richland, WA.
SURFACE STRUCTURE, BONDING, AND DYNAMICS: THE UNIVERSALITY OF ZINCBLENDE (110) POTENTIAL ENERGY SURFACES
T. J. Godin and J. P. LaFemina Nov. 1991 26 p Presented at the 38th National Symposium of the American Vacuum Society, Seattle, WA, 11-15 Nov. 1991
(Contract DE-AC06-76RL-01830)
(DE92-005454; PNL-SA-19572; CONF-911132-13) Avail: NTIS HC/MF A03

Using a tight-binding, total energy (TBTE) model we examine

the hypothesis that the potential energy surfaces (PES) describing the (110) cleavage faces of the tetrahedrally coordinated, zincblende structure compound semiconductors exhibit a common 'universal' form if expressed in terms of suitably scaled parameters. TBTE calculations on both III-V and II-VI compounds reveal a linear scaling with bulk lattice constant of the geometric parameters of the reconstructed surfaces. This scaling is analogous to that found using low energy, electron diffraction surface structure determination. The surface atomic force constants (found from a TBTE calculation) also scale monotonically with the lattice constant. Using TBTE models proposed previously for GaP, GaAs, GaSb, InP, and ZnSe, we find that the force constants scale as the inverse square of the bulk lattice constant. These results suggest that if distances are measured in units of the bulk lattice constant, the PES may be a universal function for the cleavage surface of zincblende structure compound semiconductors, on average, withsmall fluctuations from this average occurring in individual materials. DOE

N92-20220# Oak Ridge National Lab., TN.
ION IMPLANTATION RELATED DEFECTS IN GaAs
K. S. Jones, M. Bollong, T. E. Haynes, M. D. Deal, E. L. Allen, and H. G. Robinson 1991 12 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-007257; CONF-911202-52) Avail: NTIS HC/MF A03

Extended defect formation is studied in ion implanted GaAs. A number of different species including Si(+), Al(+), Mg(+), Ge(+), As(+), and Sn(+) have been investigated. Cross-sectional TEM studies have been done comparing the as-implanted structure (amorphous or crystalline) with the final defect location and morphology. The defects are identified by the same classification scheme used for implanted and annealed silicon. It is found that the threshold dose for type 1 defect formation is very sensitive to the implant energy for heavier ion masses. Type 2, 3, and 4 defects are unstable at annealing temperatures below 900 C. Type 5 defects are of a loop morphology for Si(+) and Ge(+) implants. The source of the interstitials may be a kickout process as the implanted species moves onto substitutional sites. Type 5 defects for Sn implants appear as precipitates which at the annealing temperature appear to be migrating in the liquid phase. Upon cooling the Sn precipitates, in many cases, solidify as grey (alpha) Sn. DOE

N92-20251*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.
HIGH RESOLUTION DIFFRACTION IMAGING OF CRYSTALS GROWN IN MICROGRAVITY AND CLOSELY RELATED TERRESTRIAL CRYSTALS Final Report
B. Steiner, R. Dobbyn, D. Black, H. Burdette, M. Kuriyama, R. Spal, L. vandenBerg, A. Fripp, R. Simchick, and R. Lal (Alabama A & M Univ., Normal.) et al Aug. 1991 165 p Prepared in cooperation with GTE Labs., Inc., Waltham, MA
(NASA-CR-190047; NAS 1.26:190047; PB92-109008; NIST/TN-1287) Avail: NTIS HC/MF A08; also available SOD HC $9.50 as 003-003-03092-9 CSCL 20L

Irregularities found in three crystals grown in space, in four crystals grown entirely on the ground were examined and compared. Irregularities were observed in mercuric iodide, lead tin telluride, triglycine sulfate, and gallium arsenide by high resolution synchrotron x radiation diffraction imaging. Radiation detectors made from mercuric iodide crystals grown in microgravity were reported to perform far better than conventional detectors grown from the same material under full gravity. Effort is now underway to reproduce these 'space' crystals, optimize their properties, and extend comparable superiority to other types of materials. Author

N92-20259# Ames Lab., IA.
PHENOMENOLOGICAL THEORY OF ELECTRODYNAMIC PROPERTIES OF TYPE-2 SUPERCONDUCTORS Ph.D. Thesis
M. W. Coffey 3 Jan. 1992 211 p
(Contract W-7405-eng-82)
(DE92-005363; IS-T-1577) Avail: NTIS HC/MF A10

The dissertation deals with certain electrodynamic properties of type-2 superconductors which are derived from phenomenological theory. For both discrete and continuous type-2 superconductors, vortex dynamics are investigated and their consequences described. Many of the results of the thesis are expected to apply to high-transition temperature superconductors. The subject of dimensional crossover in a layered anisotropic superconductor and its implications for vortex structure are discussed. For discrete superconductors, specific quantitative results include the viscous drag coefficient for vortex motion parallel to the layers of a Josephson-coupled layer model, the lower critical field for a parallel applied field model, and a vortex inertial mass for motion parallel to the layers. A self-consistent approach for describing the various fields and densities associated with a vortex lattice in a continuous superconductor subject to small-amplitude driving forces is developed. This approach takes into account the nonlocality of vortex interactions, yielding a complex penetration depth which in turn gives certain linear response functions such as the complex permeability. The resulting theory is expected to be valid over a wide range of magnetic inductions, temperatures, and frequencies. The frequency- and temperature-dependent vortex mobility is developed, providing a unifying tool for describing vortex dynamics. By including a random force in the vortex equation of motion and treating it as analogous to Brownian motion, the vortex mobility is extended to include flux creep effects. For continuous superconductors, specific quantitative results are given for the vortex inertial mass and dynamic mobility and complex RF surface impedance and permeability. A description of energy dissipation and screening is given in terms of the RF surface impedance and permeability. DOE

N92-20307# Oak Ridge National Lab., TN.
TEMPERATURE EFFECTS IN ION BEAM MIXING OF OXIDE-OXIDE INTERFACES
D. L. Joslin, C. J. McHargue, L. J. Romana, C. W. White, and L. L. Horton 1991 11 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005412; CONF-911202-34) Avail: NTIS HC/MF A03

Ion beam mixing of thin oxide films, Cr2O3 and ZrO2, on sapphire substrates has been studied. The systems were chosen according to their solubilities in alpha-Al2O3. Cr2O3 is completely soluble, while ZrO2 is insoluble. Mixing experiments were performed on 50 nm-thick Cr2O3 and ZrO2 films deposited on alpha-Al2O3 by radio frequency (RF) sputter deposition. The specimens were bombarded with Cr(+) at an energy of 160 keV to a fluence of 4 x 10(exp 16) ions/sq cm. Implantations were performed at 25 and 860 C. Rutherford backscattering spectroscopy was performed to analyze any interface modifications due to the bombardment. No detectable mixing was observed in either system for irradiations performed at 25 C, but a small amount of ballistic mixing was observed in both systems at 860 C. DOE

N92-20342# Argonne National Lab., IL.
SYNTHESIS AND PROPERTIES OF NEW FAMILY OF SUPERCONDUCTING COPPER OXIDES BASED ON GaO LAYERS
B. Dabrowski, V. Zhang-McCoy (University of Northern Illinois, De Kalb.), P. Radaelli, A. W. Mitchell, D. G. Hinks, J. T. Vaughey, D. A. Groenke, and K. Poeppelmeier 1991 9 p Presented at the 5th Annual Conference on Superconductivity and Applications, Buffalo, NY, 24-26 Sep. 1991
(Contract W-31-109-eng-38)
(DE92-005219; ANL/CP-74583; CONF-9109102-5) Avail: NTIS HC/MF A02

We have discovered the first layered superconducting copper oxide with small, fixed oxidation state cations separating the conducting CuO2 planes. This material, GaSr2Y(1-x)Ca(x)CuO7, is similar to YBa2Cu3O7 with the square planar copper chains replaced by chains of edge-shared GaO4 tetrahedra. Thus,

oxidation can occur only for the copper ion located in square pyramidal coordination in the CuO2 plane. The undoped parent compound, x = 0, does not show magnetic order above 4K, probably due to the presence of the thick, ionic region separating the CuO2 planes. However, this ionic region does not suppress high (Tc) superconductivity (approximately 70K) for the doped compositions. DOE

N92-20350# Argonne National Lab., IL.
FAST NEUTRON IRRADIATION EFFECTS ON MAGNETIZATION RELAXATION IN YBCO SINGLE CRYSTALS
J. G. Lensink, R. Griessen, H. P. Wiesinger, F. M. Sauerzopf, H. W. Weber (Atominstitut der Oesterreichischen Hochschulen, Vienna.), and G. W. Crabtree Jul. 1991 3 p Presented at the International Conference on Materials and Mechanisms of Superconductivity, Kanazawa (Japan), 22-26 Jul. 1991
(Contract W-31-109-eng-38)
(DE92-005218; ANL/CP-74035; CONF-910736-25) Avail: NTIS HC/MF A01

A high-quality YBa2Cu3O(7 delta) single crystal has been investigated by torque magnetometry prior to and following fast neutron irradiation to a fluence of 2 x 10(exp 21) m(exp -2) (E greater than 0.1 MeV). In addition to large enhancements of the critical current densities, which have been observed in similar form previously by Sauerzopf et al, we find a dramatic change in the relaxation behavior following irradiation. At low temperatures (less than or equal to 50 k) the relaxation rates are lowered by factors up to 4 in the irradiated state in a magnetic field of 1.5 T. At higher temperatures, on the other hand, they are enhanced compared to the unirradiated state. Both before and after irradiation, the magnetization relaxation follows a logarithmic time dependence, which we ascribe to thermally activated flux motion. DOE

N92-20425 Academy of Sciences of the Ukrainian SSR, Kiev. Inst. of Physics.
OSCILLATION SPECTRUM OF CdTe DOPED WITH IMPURITIES OF 3-D TRANSITION ELEMENTS [KOLEBATELNYI SPEKTR CDTE, LEGIROVANNOGO PRIMESIAMI 3-D PEREKHODNYKH ELEMENTOV]
I. N. Iuriichuk, S. V. Melnichuk, and V. A. Shenderovskii 1989 25 p In RUSSIAN
Copyright Avail: Issuing Activity

In this work, the phonon spectrum and the density of the compound CdTe, the calculated specific heat, and the temperature dependence of the Debye parameter are determined within the framework of a liquid ion model. Using the Green function, the local oscillation, invoked by the doping of the CdTe with admixtures of 3-d transitional elements, is calculated. The projected density of the effective frequency and the contribution of various branches of oscillation to full Jahn-Teller energy are determined.
Transl. by L.K.H.

N92-20432# Sao Paulo Univ. (Brazil). Inst. de Fisica.
OPTICAL TRANSITION MEASUREMENTS IN LASER ACTIVE MEDIUM CANDIDATES: APPLICATION TO COLOR CENTERS M.S. Thesis
E. Martins 1990 139 p In PORTUGUESE; ENGLISH summary
(DE92-608547; INIS-BR-2841) Avail: NTIS HC/MF A07

In the present work we describe a spectroscopy method that can determine the energy level diagram of a species under investigation, the decay time, the quantum efficiency, and the emission cross section. The decay time was measured by using sinusoidal pumping excitation and phase sensitive detection. Using a specially designed cryostat, we were able to measure the decay time in the temperature range of 77 to 310 K, and as a result, the temperature dependence of the quantum efficiency. DOE

N92-20434# Akademiya Nauk SSSR, Novosibirsk. Inst. Yadernoj Fiziki.
ELECTRONIC STRUCTURE OF HIGH-T(SUB c) SUPERCONDUCTORS
V. V. Flambaum and O. P. Sushkov 1990 19 p
(DE92-608987; IYaF-90-68) Avail: NTIS HC/MF A03

The band structure of doped high-T(sub c) superconductors is invesigated. Strong electron-electron Coulomb interaction and strong coupling with the excitons play important roles in the band formation. The charged quasi-particle in the x(exp 2)-y(exp 2) band has spin S=0 with a small admixture of the S=1 state. The frequency dependence of Cu nuclear quadrupole resonance on x is considered. DOE

N92-20519*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, OH.
GLASS PRECURSOR APPROACH TO HIGH-TEMPERATURE SUPERCONDUCTORS
Narottam P. Bansal Mar. 1992 51 p
(NASA-TM-105590; E-6852; NAS 1.15:105590) Avail: NTIS HC/MF A04 CSCL 20L

The available studies on the synthesis of high T sub c superconductors (HTS) via the glass precursor approach were reviewed. Melts of the Bi-Sr-Ca-Cu-O system as well as those doped with oxides of some other elements (Pb, Al, V, Te, Nb, etc.) could be quenched into glasses which, on further heat treatments under appropriate conditions, crystallized into the superconducting phase(s). The nature of the HTS phase(s) formed depends on the annealing temperature, time, atmosphere, and the cooling rate and also on the glass composition. Long term annealing was needed to obtain a large fraction of the 110 K phase. The high T sub c phase did not crystallize out directly from the glass matrix, but was preceded by the precipitation of other phases. The 110 K HTS was produced at high temperatures by reaction between the phases formed at lower temperatures resulting in multiphase material. The presence of a glass former such as B2O3 was necessary for the Y-Ba-Cu-O melt to form a glass on fast cooling. A discontinuous YBa2Cu3O(7-delta) HTS phase crystallized out on heat treatment of this glass. Attempts to prepare Tl-Ba-Ca-Cu-O system in the glassy state were not successful. Author

N92-20553# North Carolina State Univ., Raleigh.
BAND ELECTRONIC STRUCTURES AND CRYSTAL PACKING FORCES Progress Report, 1 Jul. 1989 - 13 Dec. 1991
1991 22 p
(Contract DE-FG05-86ER-45259)
(DE92-005145; DOE/ER-45259/12) Avail: NTIS HC/MF A03

This report briefly summaries our research accomplishments made during the period of July 1, 1989 to December 13, 1991. A number of significant progresses were achieved in our studies of several different classes of low-dimensional solid state materials. On the basis of tight-binding band electronic structure calculations, we investigated the electronic properties of various organic conducting salts, cuprate superconductors, and transition-metal oxide and chalcogenide metals to find structure-property correlations governing of the physical properties of these low-dimensional materials. By employing a number of different quality basis sets, we also carried out extensive ab initio SCF-MO/MP2 calculations on model molecular systems to accurately describe the weak intermolecular contact interactions governing the structures of organic donor slats and molecular crystals. Our research efforts led to about 80 publications and two important computer programs. DOE

N92-20560# Argonne National Lab., IL.
POSITRON 2D-ACAR EXPERIMENTS AND ELECTRON-POSITRON MOMENTUM DENSITY IN YBa2Cu3O(7-x)
L. C. Smedskjaer, U. Welp, Y. Fang, K. G. Bailey, and A. Bansil (Northeastern Univ., Boston, MA.) Dec. 1991 8 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract W-31-109-eng-38)
(DE92-006985; ANL/CP-75121; CONF-911202-45) Avail: NTIS HC/MF A02

We discuss positron annihilation (2D-ACAR) measurements in

the C- projection on an untwinned metallic single crystal of YBa2Cu3(7-x) as a function of temperature, for five temperatures ranging from 30 to 300 K. The measured 2D-ACAR intensities are interpreted in terms of the electron-positron momentum density obtained within the KKR-band theory framework. The temperature dependence of the 2D-ACAR spectra is used to extract a 'background corrected' experimental spectrum which is in remarkable accord with the corresponding band theory predictions, and displays in particular clear signatures of the electron ridge Fermi surface. DOE

N92-20567# Oak Ridge National Lab., TN.
GROWTH OF EPITAXIAL ZnS FILMS BY PULSED-LASER ABLATION
J. W. McCamy (Tennessee Univ., Knoxville.), D. H. Lowndes, J. D. Budai, B. C. Chakoumakos, and R. A. Zuhr Nov. 1991 6 p Presented at the Annual Fall Meeting of the Materials Research Society, Boston, MA, 2-6 Dec. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005476; CONF-911202-29) Avail: NTIS HC/MF A02

Pulsed KrF (248nm) laser ablation of a polycrystalline ZnS target has been used to grow high quality, carbon-free, epitaxial ZnS thin films on GaAs(001), GaAs(111), and GaP(001). The films were grown at temperatures of 150-450 C, using a rotating substrate heater and a deposition geometry that produces films with highly uniform thickness. X-ray rocking curves are consistent with (111) stacking faults being the dominant defects in the ZnS films grown on GaAs. The estimated stacking fault density is approximately 6 x 10(exp 10) cm(exp -3), comparable to the best MOCVD ZnS films. RBS analysis shows that these defects are located predominantly near the GaAs-ZnS interface. The anisotropy of the ZnS growth rate, between the GaAs(001) and GaAs(111) surfaces, was found to be temperature-dependent. DOE

N92-20570# Northwestern Univ., Evanston, IL. Dept. of Materials Science and Engineering.
PLASMA, PHOTON, AND BEAM SYNTHESIS OF DIAMOND FILMS AND MULTILAYERED STRUCTURES
R. P. H. Chang Nov. 1991 5 p
(Contract DE-FG02-87ER-45314)
(DE92-005529; DOE/ER-45314/4) Avail: NTIS HC/MF A01

Three major areas of fundamental research on diamond thin films were explored during the period 1990 to 1991. A new microwave plasma enhanced laser ablation system was designed and constructed. This system is currently used to study the possibility of depositing diamond films on plastic surfaces. A mechanism for nucleating diamond films on single crystal copper surfaces was proposed and detailed experiments were carried out. Carbon clusters of C70 were successfully used to nucleate diamond on non-diamond surfaces. This invention provides an alternative to using diamond-grit polish as a nucleating agent. DOE

N92-20579# North Carolina State Univ., Raleigh. Dept. of Mechanical and Aerospace Engineering.
TRANSPORT PROPERTIES OF DISORDERED POROUS MEDIA FROM THE MICROSTRUCTURE
S. Torquato Nov. 1991 8 p
(Contract DE-FG05-86ER-13482)
(DE92-005467; DOE/ER-13482/6) Avail: NTIS HC/MF A02

Progress was made in the following general research areas: (1) the development of cross-property relations, i.e., relationships between one effective property and a different effective property; (2) the development of a systematic means to represent and calculate statistical correlation functions that arise in rigorous property relations for heterogeneous media, using statistical-mechanical methods; (3) the derivation and calculation of property relations which depend upon this microstructural information; (4) sterically hindered fragmentation in reactive solids using percolation theory and simulations; and (5) the use of Brownian-motion simulation techniques to 'exactly' predict the effective properties of disordered media. Additionally, the passive advection of tracer particles in random velocity fields was studied. DOE

N92-20701# Midwest Research Inst., Golden, CO. National Renewable Energy Lab.
RESEARCH ON STABLE, HIGH-EFFICIENCY AMORPHOUS SILICON MULTIJUNCTION MODULES
S. Guha Dec. 1991 75 p Prepared in cooperation with United Solar Systems Corp., Troy, MI
(Contract DE-AC02-83CH-10093)
(DE92-001197; NREL/TP-214-4453) Avail: NTIS HC/MF A04

This report describes research to improve the understanding of amorphous silicon alloys and other relevant non-semiconductor materials for use in high-efficiency, large-area multijunction modules. The research produced an average subcell initial efficiency of 8.8 percent over a 1-ft(exp 2) area using same-band-gap, dual-junction cells deposited over a ZnO/AlSi back reflector. An initial efficiency of 9.6 percent was achieved using a ZnO/Ag back reflector over smaller substrates. A sputtering machine will be built to deposit a ZnO/Ag back reflector over a 1-ft(exp 2) area so that a higher efficiency can also be obtained on larger substrates. Calculations have been performed to optimize the grid pattern, bus bars, and cell interconnects on modules. With our present state of technology, we expect a difference of about 6 percent between the aperture-area and active-area efficiencies of modules. Preliminary experiments show a difference of about 8 percent. We can now predict the performance of single-junction cells after long-term light exposure at 50 C by exposing cells to short-term intense light at different temperatures. We find that single-junction cells deposited on a ZnO/Ag back reflector show the highest stabilized efficiency when the thickness of the intrinsic layers is about 2000 angstroms. DOE

N92-20703# Princeton Univ., NJ. Dept. of Physics.
THEORY OF SUPERCONDUCTIVITY IN OXIDES Final Report, 1 Sep. 1988 - 31 Aug. 1991
Philip W. Anderson 15 Nov. 1991 34 p
(Grant AF-AFOSR-0350-88)
(AD-A244726; AFOSR-91-1023TR) Avail: NTIS HC/MF A03 CSCL 20/12

During the period of this grant the theory of superconductivity in high Technetium cuprates matured into a reasonable, consistent, complete theory which has the capability, often realized, of confronting all of the puzzling experimental properties of the materials. During the period of the grant occurred the Cargese NATO Summer School (June 1990) attended by several of us who were being funded by the grant, and at that school I summarized progress up to that time. B. Doucot who had been one of our group was the local organizer. Perhaps the best summary of the situation at that time was given in my Chapter 2 setting out what I called the Central Dogmas of the theory, which is enclosed. At that meeting was formulated the justification of the Luttinger liquid hypothesis via a finite Fermi surface phase shift which led to several papers, especially the PRL and 'response' on the subject showing how the Fermi liquid theory breaks down. GRA

N92-20706# Wisconsin Univ., Madison. Dept. of Chemistry.
EXCITED-STATE PROPERTIES OF SEMICONDUCTOR ELECTRODES AND THEIR APPLICATION TO OPTICAL ENERGY CONVERSION Final Report, 1 Jul. 1985 - 30 Sep. 1991
Arthur B. Ellis 2 Jan. 1992 8 p
(Contract N00014-85-K-0631)
(AD-A244729) Avail: NTIS HC/MF A02 CSCL 20/12

The luminescent properties of a variety of II-VI and III-V semiconductors have been investigated. The sensitivity of photoluminescence intensity can serve as the basis for optically-coupled chemical sensors for adsorbing molecules.
Author (GRA)

N92-20851# Oak Ridge National Lab., TN.
DISORDERING AND AMORPHIZATION OF Zr3Al BY 3.8 MeV Zr(3+) ION BOMBARDMENT
F. C. Chen, A. J. Ardell, and D. F. Pedraza 1991 8 p Presented at the European Workshop on Ordering and Disordering, Grenoble

(France), 10-12 Jul. 1991
(Contracts DE-AC05-84OR-21400; DE-FG03-86ER-45264)
(DE92-005400; CONF-9107179-2) Avail: NTIS HC/MF A02

The ordered intermetallic compound Zr3Al was irradiated with 3.8 MeV Zr(3+) ions at various fluences up to 5 x 10(exp 12) tons/sq mm at a temperature of 250 C and the irradiation induced microstructures were investigated by transmission electron microscopy. Disordering began at the lowest dose, 0.0033 dpa, and complete loss of chemical long range order occurred at a dose of 0.33 dpa. The onset of amorphization was also observed at this dose. Electron diffraction patterns from irradiated samples showed satellite reflections along (011) in thin foils in (100) orientation and streaking along (111) in foils oriented (011). These diffraction effects are attributed to the presence of irradiation induced microstructural defects that, when imaged in dark field, resemble rows of dislocation loops. A model of these arrays of loops, which are suggested to have Burgers vectors of the Frank type, is proposed. The model accounts for the contrast effects observed in the images and the streaking and satellites seen in the diffraction patterns. At the highest dose, 1.6 dpa, a new phase, Zr5Al3, appeared unexpectedly, most likely as a consequence of irradiation induced solute segregation. DOE

N92-20867# Brookhaven National Lab., Upton, NY.
NEUTRON DIFFRACTION STUDY OF THE MAGNETIC ORDERING OF THE Cu(++) SPINS IN Nd(1.5)Ba(1.5)Cu3O(6+x)
A. H. Moudden, B. Hennion, and P. Schweiss 1991 2 p Presented at the International Conference on Materials and Mechanisms of Superconductivity, Kanazawa (Japan), 22-26 Jul. 1991
(Contract DE-AC02-76CH-00016)
(DE92-005146; BNL-46854; CONF-910736-24) Avail: NTIS HC/MF A01

Elastic neutron scattering experiments performed on single crystals of Nd(1.5)Ba(1.5)Cu3O(6+y) reveal successive antiferromagnetic (AF) ordering of the Cu(++) spins. The as grown single crystals show an AF structure characterized by a Neel temperature (T sub N1) approx. = 390 K and a magnetic wave vector (1/2 1/2 0) referring to the tetragonal structure of NdBa2Cu3O6. As the temperature is lowered below T sub N2 approx. = 150 K, a spin reorientation develops and a second AF ordering with (1/2 1/2 1/2) wave vector is stabilized. When the samples are oxygenated the tetragonal symmetry and the Neel temperature (T sub N1) remain unchanged, whereas the spin reorientation at T sub N2 is suppressed. The results indicate that the Nd/Ba substitution increases the stability of the tetragonal structure upon the oxygen content. This may induce new possibilities of local oxygen ordering that favor the presence of holes in the deficient layer. DOE

N92-20872# Massachusetts Inst. of Tech., Lexington. Lincoln Lab.
SOLID STATE RESEARCH Quarterly Technical Report No. 2, 1 Feb. - 30 Apr. 1991
Alan L. McWhorter 15 May 1991 88 p
(Contract F19628-90-C-0002)
(AD-A245014; Rept-1991:2; Rept-2; ESD-TR-91-106) Avail: NTIS HC/MF A05 CSCL 20/12

This report covers in detail the research work of the Solid State Division at Lincoln Laboratory for the period 1 February through 30 April 1991. The topics covered are electrooptical devices, quantum electronics, materials research, submicrometer technology, high speed electronics, microelectronics, and analog device technology. Funding is provided primarily by the Air Force, with additional support provided by the Army, DARPA, Navy, SDIO, NASA, and DOE. Author (GRA)

N92-20932# Argonne National Lab., IL.
HIGH HEAT LOAD PERFORMANCE OF AN INCLINED CRYSTAL MONOCHROMATOR WITH LIQUID GALLIUM COOLING ON THE CHESS-ANL UNDULATOR
A. T. Macrander, W. K. Lee, R. K. Smither, D. M. Mills, S. Rogers, and A. Khounsary Nov. 1991 28 p Presented at the 7th National Conference and Exhibition on Synchrotron Radiation Instrumentation, Baton Rouge, LA, 28-31 Oct. 1991
(Contract W-31-109-eng-38)
(DE92-004131; ANL/CP-74078; CONF-9110146-4) Avail: NTIS HC/MF A03

Results for the performance of a novel double crystal monochromator subjected to high heat loads from an APS prototype undulator at the Cornell High Energy Synchrotron Source (CHESS) are presented. The monochromator was designed to achieve symmetric diffraction from asymmetric planes to spread out the beam footprint thereby lowering the incident power density. Both crystals had (111) oriented surfaces and were arranged such that the beam was diffracted from the (11 bar 1) planes at 5 KeV. Rocking curves with minimal distortion were obtained at a ring electron current of 96 mA. This corresponded to 370 Watts total power and an peak power density of 48 Watts/mm(exp 2) normal to the incident beam. These results are compared to data obtained from the same crystals in the standard geometry (diffracting planes parallel to surface). The footprint area in the inclined case was three times that of the standard case. We also obtained rocking curve data for the (333) reflection at 15 KeV for both standard and inclined cases, and these data also showed a minimal distortion for the inclined case. In addition, thermal data were obtained via infrared pyrometry. Not only the diffraction data but also the thermal data revealed a dramatically improved performance for the inclined crystal case. DOE

N92-20969# Oak Ridge National Lab., TN.
TWO-DIMENSIONAL THERMOGRAPHY USING La2O2S:Eu AND Y2O2S:Eu THERMAL PHOSPHORS
J. M. Taliaferro, S. W. Allison, and K. W. Tobin Nov. 1991 18 p
(Contracts DE-AC05-84OR-21400; W-7405-eng-36)
(DE92-006867; ORNL/ATD-61) Avail: NTIS HC/MF A03

This report describes efforts to obtain two-dimensional temperature profiles of aerodynamic surfaces by using imaging techniques in conjunction with fluorescence thermometry. The fluorescence of several temperature-sensitive phosphors were observed by using an image-intensified, charge coupled device (CCD) camera. The intensity profile of the image for two emission wavelengths was stored and processed to yield temperature profiles of a coated specimen. The best results were obtained with oxysulfide phosphors, which showed temperature dependence from ambient to 200 C. The temperature resolution was about 0.5 percent C at ambient. DOE

N92-20977# Argonne National Lab., IL.
ON DIAMOND WINDOWS FOR HIGH POWER SYNCHROTRON X RAY BEAMS
A. M. Khounsary and T. M. Kuzay 1991 24 p Presented at the 7th National Conference and Exhibition on Synchrotron Radiation Instrumentation, Baton Rouge, LA, 28-31 Oct. 1991
(Contract W-31-109-eng-38)
(DE92-007366; ANL/CP-74358; CONF-9110146-9) Avail: NTIS HC/MF A03

Recent advances in chemical vapor deposition (CVD) technology has made available thin, free-standing polycrystalline diamond foils that can be used as the window material on high heat load synchrotron x-ray beamlines. Diamond windows have many advantages that stem from the exceptionally attractive thermal, structural, and physical properties of diamond. Numerical simulations indicate that diamond windows can offer an attractive and at times the only alternative to beryllium windows for use on the third generation x-ray synchrotron radiation beamlines. Utilization, design, and fabrication aspects of diamond windows for high heat load x-ray beamlines are discussed, and analytical and numerical results are presented to provide a basis for the design and testing of such windows. DOE

N92-21026# International Centre for Theoretical Physics, Trieste (Italy).
DYNAMICS OF AN EXCITON-CARRIER SYSTEM IN OPTICALLY EXCITED SEMICONDUCTORS
Ba An Nguyen Jul. 1991 14 p
(DE92-614558; IC-91/172) Avail: NTIS HC/MF A03

A set of nonlinear differential equations describing the dynamics of an exciton-photon-carrier system driven by two external classical laser fields is established taking into account the interaction between the quasiparticles as well as the screening of the photon-exciton transition due to the presence of definite exciton and carrier densities. It is shown that both stationary and transient behaviors of the system are considerably influenced by the densities. While the exciton-assisted photon-exciton transition may lead to optical tristability, it, together with the exciton-carrier interaction, modifies the parameter domains in which the phase trajectories form a limiting cycle, a torus, or a strange attractor. Thus, the system dynamics can simply be controlled by adjusting the exciton and/or the carrier densities which in turn depend on the level of the external optical pumpings. DOE

N92-21027# International Centre for Theoretical Physics, Trieste (Italy).
ON THE COMBINATION OF THE COOPER PAIR AND THE OGG PAIR IN THE HIGH-T(SUB c) OXIDE SUPERCONDUCTOR
Liyuan Zhang Aug. 1991 12 p
(DE92-614571; IC-91/217) Avail: NTIS HC/MF A03

It is argued that the superconductivity of the high-T(sub c) oxide superconductor (HTOS) can be explained by the combinating mechanism of the Cooper pair and the Ogg pair. The properties of the superconducting state of the HTOS have been calculated under this mechanism, and the theoretical results are, overall, consistent with the experiment. DOE

N92-21031# Purdue Univ., West Lafayette, IN.
MIDWEST SUPERCONDUCTIVITY CONSORTIUM
G. L. Liedl Jan. 1992 30 p
(Contract DE-FG02-90ER-45427)
(DE92-007410; DOE/ER-45427/2) Avail: NTIS HC/MF A03

The Midwest Superconductivity Consortium's, MISCON, mission is to advance the science and understanding of high (Tc) superconductivity. Programmatic research focuses upon key materials-related problems: synthesis and processing; and limiting features in transport phenomena. During the past, twenty-one projects produced over eighty-seven talks and seventy-two publications. Key achievements this past year expand our understanding of processing phenomena relating to crystallization and texture, metal superconductor composites, and modulated microstructures. Further noteworthy accomplishments include calculations on 2-D superconductor insulator transition, prediction of flux line lattice melting, and an expansion of our understanding and use of microwave phenomena as related to superconductors. DOE

N92-21060# State Univ. of New York, Buffalo. Dept. of Physics and Astronomy.
X RAY STUDIES OF MICROSTRUCTURES IN SEMICONDUCTORS AND SUPERCONDUCTING MATERIALS
Y. H. Kao 12 Nov. 1991 9 p
(Contract DE-FG02-87ER-45283)
(DE92-003663; DOE/ER-45283/10) Avail: NTIS HC/MF A02

Several different experimental investigations were carried out during the present report period. These include x ray studies of semiconductors, high-T(sub c) superconductors, and various thin films using synchrotron radiation (especially soft x ray experiments by means of our new detector) and measurements of some fundamental properties of new superconducting materials made in our laboratory at Buffalo. We have made the first systematic study of electronic structure in the high-T(sub c) superconductors La(2-x)Sr(x)CuO4 with x ranging from 0 to 0.15 by x ray absorption spectroscopy (XAS). DOE

N92-21062# Lawrence Livermore National Lab., CA.
IMPLICATIONS OF INTERFACE STRUCTURE ON THE ELASTIC PROPERTIES OF METALLIC MULTILAYERS: THE CASE OF THE SUPERMODULUS EFFECT
A. F. Jankowski May 1991 13 p Presented at the Spring Meeting of the Materials Research Society (MRS), Anaheim, CA, 29 Apr. - 3 May 1991
(Contract W-7405-eng-48)
(DE92-003701; UCRL-JC-105702; CONF-910406-37) Avail: NTIS HC/MF A03

The existence of the supermodulus effect, an enhancement in the elastic modulus of artificially layered metal films, was discovered more than a dozen years ago. Yet the detailed nature of this effect remains a puzzling phenomena. Implications of the interface structure on the elastic properties of gold-nickel multilayers are investigated using x-ray diffraction and high resolution electron microscopy. DOE

N92-21067# Lawrence Livermore National Lab., CA.
HIGH DENSITY CRYSTALLINE BORON PREPARED BY HOT ISOSTATIC PRESSING IN REFRACTORY METAL CONTAINERS Patent Application
C. L. Hoenig, inventor (to DOE) 18 Jun. 1990 12 p
(Contract W-7405-eng-48)
(DE92-003749; US-Patent-Appl-SN-539392;
Patents-US-A7539392) Avail: NTIS HC/MF A03

Boron powder is hot isostatically pressed in a refractory metal container to produce a solid boron monolith with a bulk density at least 2.22 g/cc and up to greater than 2.34 g/cc. The refractory metal container is formed of tantalum, niobium, tungsten, molybdenum or alloys thereof in the form of a canister or alternatively plasma sprayed or chemical vapor deposited onto a powder compact. Hot isostatic pressing at 1800 C and 30 KSI (206.8 MPa) argon pressure for four hours produces a bulk density of 2.34 g/cc. Complex shapes can be made. DOE

77 THERMODYNAMICS AND STATISTICAL PHYSICS

Includes quantum mechanics; theoretical physics; and Bose and Fermi statistics.

For related information see also *25 Inorganic and Physical Chemistry* and *34 Fluid Mechanics and Heat Transfer.*

N92-20126# Pennsylvania Univ., Philadelphia. Dept. of Chemical Engineering.
THERMODYNAMICS AND TRANSPORT IN MICROPOROUS MEDIA
E. D. Glandt Oct. 1991 11 p
(Contract DE-FG02-88ER-13825)
(DE92-005535; DOE/ER-13825/7) Avail: NTIS HC/MF A03

We are carrying out a rather extensive computational investigation of the geometric, topological, and transport properties of realistic models for microporous media. This research aims at facilitating the description of microporous materials by these models, by obtaining those statistics that are most readily observable, by simple tests, and by image analysis. Many efforts are being made to integrate our knowledge of the properties of disordered materials, so that knowledge of some of them can be applied to the estimation of the others. The calculation of transport properties of similar but different structures will provide a benchmark for such studies. It will also allow us to examine quantitatively the sensitivity of those properties to the details of the structure. DOE

N92-20237 California Univ., Santa Barbara.
HIGHER DERIVATIVE EXPANSIONS AND NON-LOCALITY, WITH APPLICATIONS TO GRAVITY AND THE STABILITY OF FLAT SPACE Ph.D. Thesis
Jonathan Zev Simon 1990 114 p
Avail: Univ. Microfilms Order No. DA9135774

Higher derivative theories are frequently avoided because of

undesirable properties, yet they occur naturally as corrections to general relativity and cosmic strings. Some of their more interesting and disturbing problems are discussed along with examples. A natural method of removing all the problems of higher derivative is reviewed. This method of 'perturbative constraints' is required for at least one class of higher derivative theories, those which are associated with nonlocality. Nonlocality often appears in low energy theories described by effective actions. The methods may also be applied to a wide class of other higher derivative theories. An example system is solved, exactly and perturbatively, for which the perturbative solutions approximate the exact solutions only when the method of 'perturbative constraints' is used. Ramifications for corrections to general relativity, cosmic strings with rigidity terms, and other higher derivative theories are explored. Dissert. Abstr.

N92-20297 Dartmouth Coll., Hanover, NH.
BUBBLES IN MCVITTIE SPACETIMES Ph.D. Thesis
Paul Haines 1991 81 p
Avail: Univ. Microfilms Order No. DA9130831

The evolution of bubbles is studied, in the thin shell approximation. Unlike earlier studies, the spacetime outside the bubble is endowed with a non-zero gravitational potential. This is achieved via the McVittie metric, which is a perfect fluid solution of Einstein's field equations corresponding to a spherically symmetric mass distribution embedded in an expanding universe. Numerical integrations show that the 'McVittie' mass of the spacetime affects the growth of the bubble in the expected way: when the McVittie mass is positive, which means that the bubble region is denser than the surrounding spacetime, the shell expands more slowly and is more prone to collapse; when the McVittie mass is negative, which means that the bubble is underdense, the hypersurface will expand more quickly. All calculations are presented in terms of the frame components of the Weyl-Cartan connection. Dissert. Abstr.

N92-20382# Bonn Univ. (Germany, F.R.). Inst. fuer Physik.
INDEPENDENT SU(2)-LOOP VARIABLES
R. Loll Apr. 1991 17 p
(Bonn-HE-91-06; ISSN-0172-8733; ETN-92-90835) Avail: NTIS HC/MF A03

The classical solution of the gauge group SU(2) constraints is addressed in a study relating to loop formulation of gauge and gravitational theories. A reduction procedure for SU(2) trace variables and a complete set of independent, gauge invariant and almost local loop variables for the configuration space of SU(2) lattice gauge theory in 2 + 1 dimensions are given. ESA

N92-20431# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Ehnergij.
ON EMISSION OF GRAVITATIONAL WAVES IN THE CASE OF A NONZERO GRAVITON MASS
Yu. M. Loskutov 1990 7 p
(DE92-608364; IHEP-OTF-90-178; IFVE-OTF-90-178) Avail: NTIS HC/MF A02

An expression, also valid for the relativistic case, for the intensity of emission of massive gravitons by an arbitrary source has been found. It is shown that the gravitons of spin state two contribute positively, while those gravitons with spin zero make no contribution. In the case of a spherically symmetric source, only the state corresponding to a nonzero projection of the graviton spin momentum results in emission. DOE

N92-20487*# Fermi National Accelerator Lab., Batavia, IL.
DOMAIN WALL FORMATION IN LATE-TIME PHASE TRANSITIONS
Edward W. Kolb and Yun Wang (California Univ., Santa Barbara.) Jan. 1992 23 p Prepared in cooperation with Chicago Univ., IL, and Florida Univ., Gainesville
(Contract NAGw-2831; DE-FG05-86ER-40272; NSF PHY-89-04035)
(NASA-CR-190121; NAS 1.26:190121; NSF-ITP-92-05; FNAL-Pub-92/33-A; UFIFT-HEP-92-5) Avail: NTIS HC/MF A03 CSCL 20C

We examine domain wall formulation in late time phase transitions. We find that in the invisible axion domain wall phenomenon, thermal effects alone are insufficient to drive different parts of the disconnected vacuum manifold. This suggests that domain walls do not form unless either there is some supplemental (but perhaps not unreasonable) dynamics to localize the scalar field responsible for the phase transition to the low temperature maximum (to an extraordinary precision) before the onset of the phase transition, or there is some non-thermal mechanism to produce large fluctuations in the scalar field. The fact that domain wall production is not a robust prediction of late time transitions may suggest future directions in model building. Author

80 SOCIAL SCIENCES (GENERAL)

Includes educational matters.

N92-20784# Centre National d'Etudes Spatiales, Paris (France).
IN-ORBIT LAUNCHES AND OPERATIONS: TOWARDS AN OPTIMIZED MANAGEMENT OF MEDIA EVENTS [LANCEMENTS ET OPERATIONS EN ORBITE: VERS UNE GESTION OPTIMISEE DES EVENEMENTS MEDIATIQUES]
L. Laidet *In* ESA, Launch Bases and Control Infrastructures for Spacecraft Oct. 1991 p 459-466 In FRENCH (For primary document see N92-20715 11-14)
Copyright Avail: NTIS HC/MF A21; ESA, EPD, ESTEC, Noordwijk, Netherlands, HC 90 guilders

81 ADMINISTRATION AND MANAGEMENT

Includes management planning and research.

N92-20076# Naval Postgraduate School, Monterey, CA.
REDUCING THE EFFECT OF IRRELEVANT INFORMATION WITH COGNITIVE FEEDBACK M.S. Thesis
William A. Durbin 28 Mar. 1991 80 p
(AD-A243130) Avail: NTIS HC/MF A05 CSCL 05/8

This thesis was a study which deals with two basic concepts in human decision making. The first is the role of information relevance, specifically the adverse effects of irrelevant information on decision quality. The second key concept was cognitive feedback and its value in support of decision making. The thesis was designed to research the effectiveness of cognitive feedback in reducing the adverse effects of irrelevant information. The experiment tested the Lens Model indices achievement, consistency, and matching in task conditions of high and low predictability. Subjects were divided into blocks which differed in the availability of cognitive feedback and predictability. The results of the experiment showed the subjects performed better in all Lens Model indices in the cognitive feedback condition. Subjects also had superior performance across all Lens Model indices in the high predictability condition. This thesis was intended to contribute to research in the subject of human decision making. The results were of importance in support of future design of decision support systems. GRA

N92-20166# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
SUPPORT FOR PROBLEM SOLVING IN MANPOWER PLANNING PROBLEMS
M. W. I. vanKraaij, W. Z. Venema, and Jaap Wessels Aug. 1990 13 p
(Memo-COSOR-90-30; ETN-92-91107) Avail: NTIS HC/MF A03

Construction of problem solving strategies are described in the context of well defined decision situation in which various problem situations are of interest, such as in manpower planning situations. The problem solving component of the system consists of a set of basic mathematical algorithms that can be combined to solution strategies to the stated problems. An analysis process is needed that converts the state problem to a set of subproblems that can

be solved by the available mathematical algorithms. The analysis process consists of an aggregation stage and a decomposition stage. The aim of aggregation is to decrease the size of the problem by neglecting the irrelevent information. The aim of decomposition is to be able to solve rather complex problems by the separation into sets of subproblems. ESA

N92-20240 Texas Univ., Arlington.
THE EFFECTIVENESS OF A GROUP DECISION SUPPORT SYSTEM IN AIDING VARIOUS DECISION TASK TYPES Ph.D. Thesis
Margaret Ann Holmes 1991 370 p
Avail: Univ. Microfilms Order No. DA9131756

A cumulative theoretical basis for a Group Decision Support System (GDSS) was built to increase understanding of the effects of GDSS usage on various task types. An empirical study was conducted with GDSS usage and task type as the two factors in the experiment. A total of 80 subjects participated in the study. A 2 x 2 factorial design was used for this experiment. Nine dependent variables were used to measure the efficiency and effectiveness of group decision-making. The efficiency of group decision-making was measured in terms of decision time and the number of objectives and alternatives generated. The effectiveness of group decision-making was measured in terms of decision quality and decision acceptance. Three dependent variables were used to measure decision acceptance. These were quality of participation among group members, overall decision confidence/satisfaction, and overall satisfaction with the decision making process. A total of nine hypotheses were formulated, based on these dependent variables. The results of the experiment indicated that GDSS use had a significant impact on groups faced with a Policy-Planning task type resulting in more alternatives being generated, less time necessary to reach a conclusion, and conclusions judged to be of a higher quality than their non-GDSS supported counterparts.
Dissert. Abstr.

N92-20363 Mississippi Univ., University.
AN EXPERIMENTAL INVESTIGATION OF THE RELATIONSHIP BETWEEN DECISION SUPPORT SYSTEMS AND DECISION EFFECTIVENESS Ph.D. Thesis
Patti Dawn Massey 1991 174 p
Avail: Univ. Microfilms Order No. DA9130794

The relationship between decision support systems (DSS) and decision effectiveness of DSS versus non-DSS users possessing varied human information processing styles and computer information system experience in the context of Alter's DSS taxonomy is investigated. Additionally, the research proposes a model which structurally organizes the operational measures of structural factors, environmental factors, and decision process factors influencing decision effectiveness in a DSS environment. The model incorporates the performance measures of previous DSS effectiveness evaluative studies: decision cost, decision time, decision confidence, and number of alternatives considered. In addition, the model addresses the appropriateness or the 'fit' of the task to the DSS. Six tasks were designed to serve as the task environment for this experiment. The six tasks were designed to conform to the generic operations that can be performed by a decision support system, as specified by Alter's DSS taxonomy. Subjects, after being classified according to the human information processing style and computer information system experience, were assigned to either the DSS or non-DSS treatment block. This study employed a doubly-multivariate design with repeated measures on the last factor of task. Multivariate and univariate analysis of the experimental data provided evidence of significant results due to experimental treatments. The results suggest that overall the use of a DSS does improve decision effectiveness.
Dissert. Abstr.

N92-20383# Laboratoire d'Automatique et d'Analyse des Systemes, Toulouse (France).
CELL FORMATION AND SCHEDULING IN A MANUFACTURING SYSTEM Ph.D. Thesis - Inst. National des Sciences Appliquees
Jose Francisco FerreiraRibeiro 1991 164 p In FRENCH; ENGLISH summary Sponsored by CAPES/MEC and EESC/USP (LAAS-91313; ETN-92-90853) Avail: NTIS HC/MF A08

A two phase decomposition and assignment methodology and program are proposed as an aid to organizing job shop production in a cellular manufacturing system and to scheduling workshop tasks. The decomposition phase leads to a cellular structure allowing decomposition of the global scheduling problem into subproblems of reduced size. The scheduling phase establishes the early and late start times to carry out all parts on the shop floor taking into account several parameters such as release and due dates. The methodology is shown to solve large size problems efficiently despite the non polynomial nature of the problems studied. ESA

N92-20458# Rolls-Royce Ltd., Derby (England).
THE REQUIREMENTS AND MANAGEMENT OF QUALITY AUDITS AND REVIEWS
Peter H. Smith 1 Nov. 1990 38 p Presented at the Seminar on Auditing and Assessment Standards, 10 Apr. 1990
(PNR-90840; ETN-92-90793) Copyright Avail: NTIS HC/MF A03

A set of graphics from a seminar on auditing and assessment standards is presented. The requirements and management of quality audits and reviews are explained and highlighted. ESA

N92-20541# National Academy of Sciences - National Research Council, Washington, DC. Committee on Science, Engineering, and Public Policy.
SCIENCE AND TECHNOLOGY LEADERSHIP IN AMERICAN GOVERNMENT: ENSURING THE BEST PRESIDENTIAL APPOINTMENTS
1992 96 p Sponsored in part by Carnegie Commission on Science, Technology, and Government Prepared in cooperation with National Academy of Engineering, Washinton, DC
(LC-92-60301; ISBN-0-309-04727-7) Avail: NTIS HC/MF A05

The federal government's capability to attract highly qualified individuals to serve in the top-level executive positions involved in science and technology (S&T) decision making and program management is examined. The problems encountered in recruiting and keeping talented experts, especially scientists and engineers, as presidential appointees are addressed, and recommendations for improving the situation are presented. Author

N92-20819# Technische Univ., Eindhoven (Netherlands). Dept. of Mathematics and Computing Science.
THE CONSTRUCTION OF A SOLUTION STRATEGY FOR MANPOWER PLANNING PROBLEMS
M. W. I. vanKraaij, W. Z. Venema, and J. Wessels Jan. 1991 15 p
(Memo-COSOR-91-01; ETN-92-91169) Avail: NTIS HC/MF A03

Problem solution strategies to be used in a system for medium and long term manpower planning are considered. The planning problems can include several types of aspects. Several mathematical algorithms are available, each suited to handle a specific class of these aspects. The solution strategy is constructed using aggregation and using decomposition into independent problems or into a hierarchy of dependent problems. The purpose of the decomposition is to match the properties of the resulting planning problems to the capabilities of the available numerical algorithms. The conversion of the available data to the format of the models used by the mathematical algorithms that constitute the solution strategy is described. ESA

N92-20910# Rolls-Royce Ltd., Derby (England).
COMMUNICATION OF ENGINEERING DRAWINGS IN SIMULTANEOUS ENGINEERING
D. C. Lester 20 Jul. 1990 11 p Presented at the FORMTEK User Conference, Chicago, IL, 7 Jun. 1990 and the Optical Information Systems International Conference, London, England, 18 Jul. 1990
(PNR-90800; ETN-92-90773) Copyright Avail: NTIS HC/MF A03

Experience gained during the setting up of a system for communicating large engineering drawings by the use of Raster image technology is described. This system was set up in order to support a move to simultaneous engineering. The benefits of simultaneous engineering are given, different systems considered are discussed, and the requirement specifications are listed. FORMTEK software was finally selected on the basis that it would operate on existing Computer Aided Design (CAD) equipment and would integrate easily with the database software. FORMTEK software was appropriate for the job at hand and offered the best prospects for the long term exploitation of Raster image technology. The implementation of the system and the initial problems are discussed. Future steps concerning this system are considered. ESA

N92-20927# Rolls-Royce Ltd., Derby (England).
KEYS TO EXCELLENCE IN DESIGN AND MANUFACTURE
P. C. Ruffles 1 Nov. 1990 15 p Presented at the Aerospace Technology Conference and Exposition, Portsmouth, England, 26-28 Jun. 1990
(PNR-90781; ETN-92-90767) Copyright Avail: NTIS HC/MF A03

Some of the major issues in achieving excellence in design and manufacture are illustrated. The subject is explored from the initiation of ideas, through to the generation of technological knowledge product validation. The effects on the design and manufacturing process of the new super high reliability required for extended twin engine operations at aircraft entry into service are illustrated as being the next challenge to the aerospace industry. ESA

N92-20995# Naval Postgraduate School, Monterey, CA.
PREPARING FOR THE UNEXPECTED, CONTRACTING IN CONTINGENCY SITUATIONS M.S. Thesis
Scott J. Koster Dec. 1991 121 p
(AD-A245064) Avail: NTIS HC/MF A06 CSCL 15/5

The purpose was to evaluate the quality of the preparation that contracting professionals receive prior to contingency contracting situations. This was accomplished by exploring the literature on this subject and then comparing the findings and recommendations found with recent experience of contracting professionals returning from Desert Shield and Desert Storm. Contingency contracting issues analyzed include the identification of critical demands, effectiveness of current preparation, effects of laws and regulations, and contingency contracting tools. As a result of this analysis, it can be concluded that current instruction and on-the-job training is sufficient to provide contracting professionals with the requisite competence for contingency contracting situations. There is a need to involve contracting professionals early in the contingency planning process. Current laws and regulations did not constrain procurement of supplies and services during Desert Shield/Storm. The use of contingency contracting tools are paramount to the success of the contracting function in a contingency contracting situation and need to be assembled well in advance. This study recommends the continued education and training of contracting professionals in its present form, raising the thresholds for SF 44's and small purchase procedures for contingency situations, and improvement of contingency contracting kits. GRA

N92-20612 Computer Resources International A/S (Denmark).
MANAGEMENT IN SDE-BASED ORGANISATIONS
J. Langeland-Knudsen and J. Guldberg *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 281-286 Previously announced in IAA as A91-47774 (For primary document see N92-20589 11-61)
Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

N92-20621 TECHLOG (France).
AGILE: AN EXPERT SYSTEM FOR LARGE SPACE PROJECT MANAGEMENT [AGILE, UN SYSTEME EXPERT D'AIDE A L'EXPLOITATION DES GRANDS PROJETS SPATIAUX]
Patrick Lesueur, Elisabeth Lautier, and Bernard Romeo (Centre National d'Etudes Spatiales, Toulouse, France) *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 383-390 In FRENCH Previously announced in IAA as A91-47783 (For primary document see N92-20589 11-61)
Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

N92-20622 Aerospatiale, Les Mureaux (France). Div. des Systemes Strategiques et Spatiaux.
LARGE SYSTEM CONTROL BY CENTRALIZATION OF OPERATIONAL DATA [MAITRISE D'UN GRAND SYSTEME PAR CENTRALISATION DES DONNEES OPERATIONELLES]
Bernard Guichoux *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 391-394 In FRENCH Previously announced in IAA as A91-47784 (For primary document see N92-20589 11-61)
Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

82 DOCUMENTATION AND INFORMATION SCIENCE

Includes information management; information storage and retrieval technology; technical writing; graphic arts; and micrography.

For computer documentation see *61 Computer Programming and Software.*

N92-20066# Allied-Signal Aerospace Co., Kansas City, MO.
SPECIFICATION FOR A DEFINITION CONFIGURATION MANAGEMENT SYSTEM
J. Hintz Jan. 1992 49 p
(Contract DE-AC04-76DP-00613)
(DE92-005228; KCP-613-4676) Avail: NTIS HC/MF A03

Control of documents and their relationships is an essential operational practice of the buyer. The buyer currently performs these functions through various computerized and paper systems. The buyer is planning to replace and consolidate many existing systems and to automate many manual systems. The comprehensive definition configuration management (DCM) system will do the following: Provide a unified information system to receive, transfer, approve, control, release, notify, and access definitions for projects, products, processes, tools, purchased parts, and acceptance equipment; Establish and control the authorized relationships of documents (definition configuration) to specific part numbers; Maintain metadata for all documents, change orders, configurations and control passwords, access authorizations, distribution and notification lists, titles, issues, classifications, status information, storage locations, engineering assignments, and other customer-defined data; Manage and control the change process for every document, ensure complete changes for individual documents, identify all related changes, and coordinate all changes to product configuration definitions; and Minimize the use of repetitive information in the database. DOE

N92-20150*# National Aeronautics and Space Administration, Washington, DC.
UNIFICATION: AN INTERNATIONAL AEROSPACE INFORMATION ISSUE
Gladys A. Cotter and Thomas F. Lahr Nov. 1991 10 p Presented at the AIAA Aerospace Sciences Meeting, Reno, NV, 6-9 Jan. 1992
(NASA-TM-105101; NAS 1.15:105101) Avail: NTIS HC/MF A02 CSCL 05B

Science and technology projects are becoming more and more international and interdisciplinary. Other parts of the world, notably Europe, are increasingly powerful players in the aerospace business. This change has led to the development of various aerospace information initiatives in other countries. With scarce resources in all areas of government and industry, the NASA STI

Program is reviewing its current acquisition and exchange practices and policies to factor in the changing requirements and new opportunities within the international community. Current NASA goals and activities are reviewed with a view toward developing a scenario for establishing an international aerospace data base, maintaining compatibility among national aerospace information systems, eliminating duplication of effort, and sharing resources through international cooperation wherever possible. Author

N92-20284 Illinois Inst. of Tech., Chicago.
KNOWLEDGE-BASED DATABASE DESIGN AND DATABASE DEVELOPMENT TOOLS Ph.D. Thesis
Hsiaoying Sharon Liu 1991 379 p
Avail: Univ. Microfilms Order No. DA9136148

The problem of providing computer support for every stage in the data base design and development processes is addressed. The DBSGen system collects the end users' data and data base requirements and generates the data base schema. Currently, the generation process consists of requirements specification, design, and development with models. The methodology proposed takes end users' data and data base requirements and creates a set of Data Models (DM). The conceptual models are then mapped into a set of design models, DataBase Models (DBM). Complete information about each target language is stored in the knowledge base using a generic Data Description Language (DDL). Once a target DBMS is selected from the knowledge base, a cross check between the DBM and constraints of the target language and target DBMS is performed. The DBM is then mapped into the target DBMS DDL. This is the target data base schema. Finally, each generated schema is tested on the defined attributes such as access time, storage space, and creation time by simulation. Depending upon the test results, a more efficient target language might be selected. DBSGen is designed to run as a stand alone system or to form part of the Prototype Work Bench.
Dissert. Abstr.

N92-20304# Assistant Secretary of Defense (Communications Command Control and Intelligence), Washington, DC.
DEPARTMENT OF DEFENSE CORPORATE INFORMATION MANAGEMENT (CIM)
Apr. 1991 38 p Sponsored in part by Assistant Secretary of Defense (Production and Logistics), Washington, DC
(PB92-120237) Avail: NTIS HC/MF A03 CSCL 05B

The CIM initiative is part of the President's overall effort to improve the management of the DoD. The Defense Management Report (DMR) contains outlined policies and directions the DoD is taking to maintain or improve defense capabilities, even in times of austere resource availability. CIM is one of the management methods for achieving DMR cost reductions while maintaining or improving the effectiveness of DoD military missions. The primary objective of CIM is business process improvement. The role of information technology is supportive and allows the adoption of more efficient and effective business area management practices. CIM acts as an enabler for many DMR initiatives and their associated cost savings. The status and progress of CIM is given.
Author

N92-20368 Arizona Univ., Tucson.
FEASIBILITY STUDY OF FOCUSING GRATING COUPLERS FOR OPTICAL DATA STORAGE Ph.D. Thesis
Shiow-Hwei Hwang 1991 160 p
Avail: Univ. Microfilms Order No. DA9200038

Analysis tools for the study of integrated devices are investigated. The devices have specific applications in optical-disk memory systems, including the gradient-index media used in waveguide lenses and the waveguide focusing grating coupler. Previous studies of gradient-index components were largely either strictly geometrical in nature or based on the split-step procedure, neither of which are sufficient for design and analysis purposes. In this dissertation, some beam propagation methods based on paraxial optics are presented. These methods facilitate diffraction propagation calculation in all types of optical systems that have modest amounts of aberrations, including gradient-index elements. It is also shown that not only is it possible to apply the beam propagation method accurately to stigmatic gradient-index media, but also a propagation distance of any length may be taken without using the split-step method. The Maxwell's fisheye lens is discussed in detail to show application of these methods. Waveguide focusing grating couplers are modeled in detail. The polarization theory of these devices differs from the theory of conventional gratings because of the conversion of guided waves to radiated waves. A simple theory based on induced dipoles is presented to study the polarization conversion effect in the radiated field of a grating coupler under the general case of oblique incidence. Calculations of this model indicate that the Transverse Electric (TE) guided mode will be well-behaved but a high degree of variation of elliptical polarization will be generated by the Transverse Magnetic (TM) guided mode. It is also shown that despite the simplicity of the analytical formulations, the agreement with experiment is high and adequate for practical design purposes. Dissert. Abstr.

N92-20456# Gesellschaft fuer Mathematik und Datenverarbeitung, Saint Augustin (Germany, F.R.).
TEXTUAL MODELING OF MEANING PARAPHRASES FOR THE ACQUISITION OF CONCEPTUAL DEFINITIONS
B. Firzlaff and K. Haenelt 1991 12 p
(PB92-114719; GMD-577) Copyright Avail: NTIS HC/MF A03 CSCL 05B

A new method is proposed of textually modeling meaning paraphrases in order to gain a formal representation of the conceptual information conveyed in meaning paraphrases. How meaning paraphrases are subjected to a manual text analysis process in accordance with the KONTEXT model is described. The principles shown are general principles of text analysis and are also applied to textural analysis of corpora in the KONTEXT system (provided a basic set of dictionary entries is available). First, the framework of the modeling is introduced. Then criteria are given for recognizing textural phenomena on the expression side, and the effects are described which these phenomena have on the construction of a formal semantic representation. The effects include concept selections, inferences, and concept integration. The criteria and operations described are used as coding instructions. An encoding example is provided. Author

N92-20488 Arizona Univ., Tucson.
DIRECT OVERWRITE IN MAGNETO-OPTICAL RECORDING Ph.D. Thesis
Mathew David Watson 1991 116 p
Avail: Univ. Microfilms Order No. DA9136873

Direct overwrite in magneto-optical recording is necessary to overcome the latency incurred by conventional erase before write recording on magneto-optical disks. We theoretically analyze the thermomagnetic recording process on optical disks using a domain wall motion model. The wall motion model that was developed can be used to examine overwrite schemes on both bilayer and single layer disks, that either rotate beneath an optical head or remain stationary. The model is directly compared with experiment for a GdTbFe direct overwrite sample, and is shown to produce results that are in agreement with experimental observations. We show that variations in the domain wall saturation velocity can mean the difference between writing or erasing a bit on the disk, and hence is a critical parameter in the recording process. We also show that direct overwrite by means of interior nucleation is highly unlikely. Rather, we show that the recording process involves a dynamic balance between those pressures which act to move the domain wall and those which act to freeze it into place. Finally, we analyze the Nikon bilayer direct overwrite scheme, and then demonstrate an alternative bilayer scheme which avoids a major problem with the Nikon scheme. Dissert. Abstr.

N92-20489# National Inst. of Standards and Technology, Gaithersburg, MD.
GUIDELINES FOR THE EVALUATION OF FILE TRANSFER, ACCESS AND MANAGEMENT IMPLEMENTATIONS
P. Markovitz, S. Trus, and C. Royster Oct. 1991 85 p Sponsored

in part by Army; UAF; and IRS
(PB92-126580; NIST/SP-50/196) Avail: NTIS HC/MF A05; also available SOD HC $5.50 as 003-003-03120-8 CSCL 05B

The document advances the goals of the Government Open Systems Interconnection Profile (GOSIP) by providing guidelines for evaluating File Transfer, Access and Management (FTAM) implementations. These guidelines can assist a user in determining which implementation, among several candidates, will best meet the functional and performance requirements of the user. Specifically, the document contains: (1) guidelines for evaluating the functional specifications of the FTAM implementations; (2) guidelines for measuring the performance of FTAM implementations; and (3) guidelines for matching the functional and performance specifications of an FTAM implementation to the functional and performance requirements of the user. GRA

N92-20516*# National Aeronautics and Space Administration, Washington, DC.
UNIFICATION: AN INTERNATIONAL AEROSPACE INFORMATION OPPORTUNITY
Gladys A. Cotter, Thomas F. Lahr, and Bonnie C. Carroll Jan. 1992 10 p Presented at the Conference on Management and Information: From Information Evaluation to Decision, Strasbourg, France, 15-17 Jan. 1992; cosponsored by AAAF, AIAA, DGLR, and RAeS
(NASA-TM-107767; NAS 1.15:107767) Avail: NTIS HC/MF A02 CSCL 05B

Science and technology projects are becoming more and more international and interdisciplinary. Other parts of the world, notably Europe, are increasingly powerful players in the aerospace industry. This change has led to the development of various aerospace information initiatives in other countries. With scarce resources in all areas of government and industry, the NASA STI Program is reviewing its current acquisition and exchange practices and policies to factor in the changing requirements and new opportunities within the international community. Current NASA goals and activities are reviewed with a new view toward developing a scenario for establishing an international aerospace database, maintaining compatibility among national aerospace information systems, eliminating duplication of effort, and sharing resources through international cooperation wherever possible. Author

N92-20542# Library of Congress, Washington, DC.
ANTARCTIC BIBLIOGRAPHY, VOLUME 18
S. G. Hibben 1991 507 p
(PB92-106384; LC-65-61825) Avail: NTIS HC/MF A22; also available SOD HC $35.00 as 030-018-00029-0 CSCL 05B

An abstract and indexes of current Antarctic literature are given. The materials are compiled over a period of 12 months, the cutoff date for inclusion being December 1990. Four indexes are provided: an author index, a subject index, a geographic index, and a grantee index. GRA

N92-20582# Lawrence Livermore National Lab., CA.
CGVU: A CGM VIEWER AND EDITOR REQUIREMENTS DOCUMENT: VERSION 1.2
D. Handeli, ed. and J. Rowe, ed. Nov. 1991 30 p
(Contract W-7405-eng-48)
(DE92-006430; UCRL-ID-108749) Avail: NTIS HC/MF A03

CGVU is a program designed to view and edit Computer Graphics Metafiles (CGM) on a large number of computer platforms. Its capabilities will allow the user community to phase out the use of Display List Intermediate (DLI) files and DLTV, and instead use the new CGM standard for all their graphics work. CGVU needs to perform three distinct functions: (1) display the CGM file on a variety of output devices; (2) add output primitives, such as text, to CGM pictures; and (3) edit any part of the displayed picture. The design of CGVU must allow both a command line interface, as well as a Motif menu driven interface. Implementation must include use of industry standard graphics libraries. Implementation must be portable to many platforms. DOE

N92-20652# National Inst. of Standards and Technology, Gaithersburg, MD. Office of Information Services.
DATA BASES AVAILABLE IN THE RESEARCH INFORMATION CENTER OF THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
Diane Cunningham Sep. 1991 131 p
(PB92-109016; NIST/SP-818) Avail: NTIS HC/MF A07; also available SOD HC $6.50 as 003-003-03101-1 CSCL 05B

Data bases available online in the Research Information Center of the National Institute of Standards and Technology (NIST) are listed by acronym and by full title. In addition, descriptions of the data bases, dates covered, producers, hard copy counterpart, principal sources, and vendors are listed. A general subject index and a cross reference index are also provided. GRA

N92-20816# National Inst. of Standards and Technology, Gaithersburg, MD.
JOURNAL OF RESEARCH OF THE NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY, JULY - AUGUST 1991, VOLUME 96, NUMBER 4
1991 100 p
(PB92-110261; LC-89-656121) Copyright Avail: NTIS HC/MF A05; also available SOD HC $3.75 as 703-027-00041-5 CSCL 05B

Articles are presented on the following topics: general analytical correction for probe-position errors in spherical near-field measurements; data for room fire model comparisons; and numerical modeling of silicon photodiodes for high-accuracy applications - simulation programs, interpreting oxide-bias experiments, and interpolating and extrapolating internal quantum-efficiency calibrations. GRA

N92-20821# National Technical Information Service, Springfield, VA.
NATIONAL TECHNICAL INFORMATION SERVICE Annual Report, FY 1990
1990 47 p
(PB92-119643) Avail: NTIS HC/MF A03 CSCL 05B

The Trade Act passed in 1988 authorized the National Technical Information Service (NTIS) to modernize its operations, enter into cooperative agreements with the private sector, and strengthen its representation in technology issues both within the U.S. and abroad. During 1990, NTIS progress in these areas was significant, while at the same time the agency maintained its momentum in serving both its source agencies and its constituents. The contents of this annual report include the following: legislative authority, operational accomplishments, financial and operational summary, modernization progress and operational improvements, audit results, financial statements, and the modernization plan. GRA

N92-20936# Nijmegen Univ. (Netherlands). Dept. of Information Systems.
DEDUCING RELEVANT INFORMATION USING THE INFORMATION DISCLOSURE MACHINE
P. D. deBruza and T. P. vanderWeide 12 Jun. 1991 19 p
Sponsored in part by Commission of the European Communities
(TR-91-14; ETN-92-90900) Avail: NTIS HC/MF A03

Information disclosure as a deductive process is considered. The disclosure machine as a paradigm for matching user queries with characterizations of information objects is introduced. The disclosure machine is based on the following corner stones: logical inference for proving relevancy; plausible inference for computing relevance and proximity for balancing relevancy; plausible inference of computing relevance; and proximity for balancing relevance according to object coherence (hypertext). The limitations of state of the art approaches are discussed and the hyperindex machine is suggested as an improved mechanism. This machine is based on the concept of index expressions. Such expressions provide a more complete characterization mechanism for objects. ESA

N92-20937# Nijmegen Univ. (Netherlands). Dept. of Information Systems.
TOWARDS DATABASE OPTIMIZATION BY EVOLUTION

P. vanBommel and T. vanderWeide 14 Jun. 1991 18 p Sponsored in part by Commission of the European Communities (TR-91-15; ETN-92-90901) Avail: NTIS HC/MF A03

Optimization of database schema transformation, by evolutionary (or genetic) search, is addressed. A framework for transforming conceptual data schemata into efficient internal schemata is presented. This problem is considered from the viewpoint of searching through the space of all correct, but possibly incomplete, internal representations of the conceptual schema at hand. A search strategy is established, based on the use of evolutionary operators. The relevant evolutionary operators are introduced. ESA

N92-20944# National Research Council of Canada, Ottawa (Ontario). Inst. for Information Technology.

[ACTIVITIES OF THE INSTITUTE FOR INFORMATION TECHNOLOGY] Annual Report, 1990 - 1991

Jul. 1991 34 p Original contains color illustrations

(ISSN-1183-9082; CTN-92-60421) Avail: NTIS HC/MF A03

The National Research Council of Canada (NRC) is the premier science and engineering organization of the Government of Canada. In 1990-91, it had an annual budget of 400 million dollars and more than 3000 employees working in research institutes and a variety of programs and facilities across the country. NRC accounts for about 10 percent of federal expenditures on science and technology. NRC is comprised of three main divisions, engineering and technology, science, and biotechnology, which include 16 research institutes in a variety of fields. Included among these institutes is the Institute for Aerospace Research, the Institute for Mechanical Engineering, the Hertzberg Institute of Astrophysics, and the Industrial Materials Institute. An in-depth presentation is included on activities of the Institute for Information Technology (IIT). Significant research and development areas of the IIT include development of photonic and photonic-electronic computer systems, research into 3-D vision, development of knowledge based systems, development of an intelligent engine health monitoring and diagnostics system, space robotics, optical computing systems, and the Harmony operating system. CISTI

N92-20986# Department of Defense, Washington, DC. Directorate for Information Operations and Reports.

CATALOG OF DIOR REPORTS, JULY 1991

Jul. 1991 12 p

(AD-A245041) Avail: NTIS HC/MF A03 CSCL 05/9

This catalog contains information on publications produced by the Department of Defense, Washington Headquarters Services, Directorate for Information Operations and Reports (DoD/WHS/DIOR). Included are the publication number, title, frequency, a brief description of the report's contents, number of pages, and estimated date that the publication will be available. The information has been organized according to the major functional areas, e.g., financial management, logistics, manpower, and procurement. The availability date listed in the catalog is the approximate date that the publication can be obtained from the Government Printing Office. It takes one to two months beyond that date before the publication is available at the National Technical Information Service. GRA

N92-21013# Lowell Univ., MA. Dept. of Electrical Engineering.

ON STABLE SELF-PUMPED PHASE CONJUGATION IN BaTiO3 FOR HIGH DENSITY STORAGE AND READOUT

F. C. Lin and M. A. Fiddy 1991 25 p

(Contract N00014-89-J-1158)

(AD-A244597) Avail: NTIS HC/MF A03 CSCL 09/1

We present experimental results and observations on parameters affecting the storage and stable read-out of information based on self-pumped phase conjugation (SPPC) in BaTiO3 (barium titanate). A storage scheme is described which exploits fanning in horizontal planes within the crystal. The stability of SPPC reflectivity is strongly temperature dependent, as well as being dependent on the spatial frequency content of the stored data. The stability of the conjugated signal can be greatly improved by decreasing the temperature of the crystal and by increasing spatial frequency content, for example, by artificially introducing a spatial carrier frequency. A so-called self-pumped phase conjugation (SPPC) in BaTiO3 crystals has been exploited in various optical devices and device architectures such as interferometers, oscillators, optical neural networks, and dynamic holographic memory storage and processing. GRA

N92-21033# Oak Ridge K-25 Site, TN.

PROJECT RECORDS INFORMATION SYSTEM (PRIS) USER'S MANUAL

P. S. Smith, J. A. Nations, and R. D. Short Aug. 1991 72 p Revised

(Contract DE-AC05-84OT-21400)

(DE92-000149; K/CSD/TM-93-Rev-1) Avail: NTIS HC/MF A04

The Projects Record Information System (PRIS) is an interactive system developed for the Information Services Division (ISD) of Martin Marietta Energy Systems, Inc., to perform indexing, maintenance, and retrieval of information about Engineering project record documents for which they are responsible. This PRIS User's Manual provides instruction on the use of this system. Section 2.0 of this manual presents an overview of PRIS, describing the system's purpose; the data that it handles, functions it performs; hardware, software, and access; and help and error functions. Section 3.0 describes the interactive menu-driven operation of PRIS. Appendixes A, B, C, and D contain the data dictionary, help screens, report descriptions, and a primary menu structure diagram, respectively. DOE

N92-21035# Oak Ridge National Lab., TN.

TERMINOLOGICAL ASPECTS OF DATA ELEMENTS

R. A. Strehlow, W. H. Kenworthey, Jr., and R. E. Schuldt (Martin Marietta Aerospace, Bethesda, MD.) 1991 11 p Presented at the American Society for Testing and Materials (ASTM) Meeting on Standardizing Terminology for Better Communication, Cleveland, OH, 12-19 Jun. 1991

(Contract DE-AC05-84OR-21400)

(DE92-001676; CONF-9106286-1) Avail: NTIS HC/MF A03

The creation and display of data comprise a process that involves a sequence of steps requiring both semantic and systems analysis. An essential early step in this process is the choice, definition, and naming of data element concepts and is followed by the specification of other needed data element concept attributes. The attributes and the values of data element concept remain associated with them from their birth as a concept to a generic data element that serves as a template for final application. Terminology is, therefore, centrally important to the entire data creation process. Smooth mapping from natural language to a database is a critical aspect of database, and consequently, it requires terminology standardization from the outset of database work. In this paper the semantic aspects of data elements are analyzed and discussed. Seven kinds of data element concept information are considered and those that require terminological development and standardization are identified. The four terminological components of a data element are the hierarchical type of a concept, functional dependencies, schematas showing conceptual structures, and definition statements. These constitute the conventional role of terminology in database design. DOE

N92-20625 European Space Agency. European Space Operations Center, Darmstadt (Germany, F.R.).

A STRATEGY FOR DATA PROCESSING WITHIN THE GROUND SEGMENT OF ESA'S IN ORBIT INFRASTRUCTURE

M. Clendining *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 421-433 Previously announced in IAA as A91-47787 (For primary document see N92-20589 11-61)

Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

N92-20629 Societe Anonyme de Telecommunications, Toulouse (France).
DATA PROCESSING ASPECTS OF THE HERMES FLIGHT CONTROL CENTER [LES ASPECTS DATA PROCESSING DANS LE CENTRE DE CONTROLE EN VOL HERMES]
Francois Martin-Dupont *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 479-494 In FRENCH Previously announced in IAA as A91-47791 (For primary document see N92-20589 11-61)
Copyright Avail: CEPADUES-Editions, 111 Rue Nicolas-Vauquelin, 31100 Toulouse, France

83 ECONOMICS AND COST ANALYSIS

Includes cost effectiveness studies.

N92-20319# Economic Research Service, Washington, DC. Agriculture and Trade Analysis Div.
DOCUMENTATION OF THE STATIC WORLD POLICY SIMULATION (SWOPSIM) MODELING FRAMEWORK
V. Roningen, J. Sullivan, and P. Dixit Sep. 1991 205 p
(PB92-114610; AGES-91-51) Avail: NTIS HC/MF A10 CSCL 05C

The Static WOrld Policy SIMulation (SWOPSIM) model building framework is documented. The framework consists of computer programs which generate standard global partial equilibrium models in spreadsheets. SWOPSIM models are designed to simulate the effect of changes in producer and consumer support policies on production, consumption, and trade. Topics covered include the economics of SWOPSIM model and the mechanics of the model building with the SWOPSIM framework. An extensive reference section lists source documents as well as published studies that have used the framework. The bulk of the documentation consists of detailed appendices which include annotated listings of variable definitions and model equations, a listing of a SWOPSIM demonstration model, screens of computer tutorials on SWOPSIM model building, printouts of the computer programs making up the SWOPSIM framework, and SWOPSIM installation instructions.
Author

84 LAW, POLITICAL SCIENCE AND SPACE POLICY

Includes NASA appropriation hearings; aviation law; space law and policy; international law; international cooperation; and patent policy.

N92-20389# Commission on US-Japan Relations for the Twenty First Century, Washington, DC.
COMMISSION ON US-JAPAN RELATIONS FOR THE 21ST CENTURY: AMERICA'S STAKE IN THE FUTURE OF THE US-JAPAN RELATIONSHIP-ISSUES AND RECOMMENDATIONS Final Report
1991 34 p Sponsored in part by Ford Foundation, New York; and Rockefeller Bros. Fund, New York
(PB92-114149) Copyright Avail: NTIS HC/MF A03 CSCL 05D

America's relationship with Japan is coming to the end of an era. That era was one of progress and growing interdependence but it was also characterized by rising tension over the way the two countries manage their economies. In the past, a common overriding interest in containing the threat from the Soviet Union sheltered U.S.-Japan ties from the effects of trade and other economic frictions. In the post-Cold War period, however, a new basis for the relationship between the U.S. and Japan will have to be established or economic conflict could bring the alliance to an end. Recommendations are made which are intended to help shape the development of a new U.S.-Japan relationship for the coming century.
Author

N92-20700# Commission on US-Japan Relations for the Twenty First Century, Washington, DC.
PREPARING FOR A PACIFIC CENTURY: EXPLORING THE POTENTIAL FOR PACIFIC BASIN COOPERATION. PERSPECTIVES FROM AN INTERNATIONAL CONFERENCE
G. W. Shinoda and F. J. McNeil 1991 170 p Conference held in Washington, DC, 16-17 Jul. 1991
(PB92-114156) Avail: NTIS HC/MF A08 CSCL 05D

A collection of papers is presented on the following topics: exploring the U.S.-Japan relationship in a pacific context; can the pacific save the U.S.-Japan economic relationship; the pacific's role in moderating U.S.-Japan economic conflicts; business independence and intrafirm trade in the pacific area; can the U.S. and Japan save the pacific; perspectives from the pacific rim; in search of post-containment stability in the pacific; pacific basin trade and its implications; pacific development; the environment and prosperity.
GRA

85 URBAN TECHNOLOGY AND TRANSPORTATION

Includes applications of space technology to urban problems; technology transfer; technology assessment; and surface and mass transportation.

For related information see also *03 Air Transportation and Safety, 16 Space Transportation,* and *44 Energy Production and Conversion.*

No abstracts in this category.

88 SPACE SCIENCES (GENERAL)

No abstracts in this category.

89 ASTRONOMY

Includes radio, gamma-ray, and infrared astronomy, and astrometry.

N92-20069*# Smithsonian Astrophysical Observatory, Cambridge, MA.
GENERATION OF COMPLETE SOURCE SAMPLES FROM THE SLEW SURVEY Semiannual Report No. 1, 15 Aug. 1991 - 14 Feb. 1992
Jonathan Schachter Feb. 1992 85 p
(Grant NAG5-1746)
(NASA-CR-190072; NAS 1.26:190072) Avail: NTIS HC/MF A05 CSCL 03A

The Einstein Slew Survey consists of 819 bright X-ray sources, of which 636 (or 78 percent) are identified with counterparts in standard catalogs. We argue for the importance of bright X-ray surveys, and compare the slew results to the ROSAT all-sky survey. Also, we discuss statistical techniques for minimizing confusion in arcminute error circles in digitized data. We describe the 238 Slew Survey AGN, clusters, and BL Lac objects identified to date and their implications for logN-logS and source evolution studies. Also given is a catalog of 1075 sources detected in the Einstein Imaging Proportional Counter (IPC) Slew Survey of the X-ray sky. Five hundred fifty-four of these sources were not previously known as X-ray sources.
Author

N92-20146*# StarStuff, Inc., Greenbelt, MD.
WINDOWS IN THE MILKY WAY Final Report, 15 Oct. 1990 - 14 Dec. 1991
William H. Waller, Lowell Evan Tacconi-Garman, Francois Boulanger, and Koryo Okumura (Observatoire de Paris, France) 20 Dec. 1991 23 p
(Grant NAG5-1424)
(NASA-CR-189772; NAS 1.26:189772) Avail: NTIS HC/MF A03 CSCL 03A

The objectives were twofold: (1) to study the IRAS emission levels in the vicinity of Baade's Window and in other optically transparent regions near the Galactic Center; and (2) to study the IRAS emission levels along sightlines in the Milky Way that exhibit very little CO emission. Tests were attempted to see whether the optically transparent 'windows' near the Galactic center can be identified (as FIR-weak regions) in the IRAS data base; and if so, whether the CO weak regions found elsewhere in the Milky Way represent similarly FIR weak and thus optically transparent sightlines through the Galaxy. The CO weak regions were also targeted in an effort to study the diffuse intercloud dust and its warming by the interstellar radiation field. Author

N92-20226 California Univ., Berkeley.
AN OPTICAL AND NEAR INFRARED SEARCH FOR A PULSAR IN SUPERNOVA 1987A Ph.D. Thesis
Timothy Paul Sasseen 1990 80 p
Avail: Univ. Microfilms Order No. DA9126763

The search for an optical pulsar in the remnant of Supernova 1987A is described. Over one hundred separate observations of the supernova, covering wavelengths from 3500 angstroms to 1.8 microns, with sensitivity to pulsations as faint as magnitude 22.7, were performed. As of September 26, 1990, the evidence for pulsations due to a pulsar in the supernova was not yet visible. The implications of this result on predictions of pulsar optical luminosity are discussed. Two photodiode detectors and a data system were constructed for this search. The devices are described in terms of their design, calibration, and performance. The detectors showed an increase in sensitivity, by a factor of 5, as compared with standard photomultiplier tubes. This performance gain extended the search to near infrared wavelengths.
Dissert. Abstr.

N92-20279# Cambridge Univ. (England). Inst. of Astronomy.
[ACTIVITIES OF CAMBRIDGE UNIV., INSTITUTE OF ASTRONOMY] Annual Report, 1990 - 1991
1991 58 p
Avail: NTIS HC/MF A04

The annual report of the research activities at Cambridge Univ. is reported for the year of 1990 to 1991. The areas of study included the following: solar physics; stars, including binary stars; galactic structure and dynamics; galaxy surveys and clustering; quasars, etc.; physics of active galactic nuclei; miscellaneous theory; and instrumentation and techniques. E.R.

N92-20292 California Univ., San Diego.
OBSERVATIONS OF GALACTIC POSITRON ANNIHILATION RADIATION Ph.D. Thesis
Michael Stephen Briggs 1991 251 p
Avail: Univ. Microfilms Order No. DA9131786

Observations are reported of galactic positron annihilation radiation made by a Hard X ray and Low Energy Gamma Ray Instrument on the first High Energy Astronomical Observatory Satellite. This instrument surveyed the sky almost three times. Its medium energy detectors had an energy range of 100 to 2000 keV, 9 pct. FWHM energy resolution at 511 keV and 17 deg FWHM fields of view. Three maps of the galactic sky in the energy band 333 to 583 keV, one map for each survey of the sky, are presented in order to locate sources of positron annihilation radiation. The presence of emission spatially extended in the galactic plane is shown for all three surveys. Also present with high statistical significance in the fall of 1977 is a point source of positron annihilation radiation. This source was weaker in the second and third surveys, showing that it is smaller than about six light months. The best fit location of the point source is well below the plane. The only HEAO A-1 catalog source present within the 90 pct. confidence region is the cataclysmic variable V1223 Sgr. The positron emission of the point source appears as a broad spectral feature. Dissert. Abstr.

N92-20294 Harvard Univ., Cambridge, MA.
THE ENERGETIC X RAY IMAGING TELESCOPE EXPERIMENT: INSTRUMENT DEVELOPMENT AND OBSERVATIONS OF BLACK HOLE CANDIDATES IN BINARIES Ph.D. Thesis
Corbin Edward Covault 1991 317 p
Avail: Univ. Microfilms Order No. DA9131933

The Energetic X ray Imaging Telescope Experiment (EXITE) is a balloon-borne hard x ray telescope with sensitivity in the 20 to 300 keV energy range. EXITE uses a 34.5 cm diameter NaI scintillation crystal bonded to the photocathode of a large image intensifier tube. Imaging is accomplished through a graded uniformly redundant array coded aperture mask to give 22 arcminute resolution over a 3.3 deg FWHM field of view. Detector and gondola systems design, assembly, and testing is described including techniques for detector calibration before and during flight. Also described is the gondola pointing and ground based command and data acquisition systems. Observations were obtained during two flights. Detector and gondola system performance during these flights is evaluated. The methods are discussed for image processing and spectral analysis with emphasis on calibration results and the impact of nonuniform background on image reconstruction. Observations are discussed in terms of power law spectral signatures for black holes and constraints on inverse Compton models. Observations are presented of black hole candidates Cygnus X-1 and GX339-04. Observations are also presented of the galactic center region. Dissert. Abstr.

N92-20367 Arizona Univ., Tucson.
OBSERVATIONAL STUDIES OF INTERSTELLAR AND SOLAR NEBULA NITROGEN CHEMISTRY Ph.D. Thesis
Maria Page Womack 1991 115 p
Avail: Univ. Microfilms Order No. DA9124856

Despite the high cosmic abundance of nitrogen, chemical models of nitrogen-bearing species in the interstellar medium and the primordial solar nebula are not constrained significantly by observations. Essentially nothing is known about the abundance of the simplest and most stable nitrogen compound N2 in astronomical sources. Ion-molecule chemistry models of interstellar clouds predict that molecular ions are formed primarily in cold, quiescent gas. The only well-studied molecular ion in dense clouds, HCO(+), is very abundant in regions of energetic outflows from young stars, contrary to model predictions. Therefore, observations of another molecular ion are needed to better understand ion-molecule models. Here we present millimeter-wave observations of N2H(+) toward galactic molecular clouds. These data can provide constraints on both the nitrogen and ion-molecule chemistry in the interstellar medium. Measured excitation temperatures of N2H(+) were found to be low (T(sub ex) approximately 5-30 K), and the line profiles narrow (delta-v(sub 1/2) approximately 3-5 km s(exp -1)), which imply that N2H(+) is produced primarily in quiescent gas, in agreement with ion-molecule models. In addition, a map of N2H(+) emission toward Orion-KL revealed for the first time that two distinct clouds in collision may be triggering the star formation processes in this star-forming region. Abundances calculated for N2H(+) imply that the quiescent gas in dense clouds has reached a steady-state chemistry. Abundances of interstellar N2 were derived for the first time directly from the N2H(+) data, and are approximately 100 times lower than those predicted by ion-molecule models. These observations provide the first critical diagnostic for the extent of chemical processing in the early solar nebula. Dissert. Abstr.

N92-20463# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik.
A CLUSTER OF HeI EMISSION LINE STARS IN THE GALACTIC CENTER
A. Krabbe, R. Genzel, S. Drapatz, and V. Rotaciuc Jun. 1991

22 p Submitted for publication
(MPE-Preprint-206; ETN-92-91015) Copyright Avail: NTIS HC/MF A03

Resolution imaging spectroscopy data of HeI n=2(sup 1)P yields n=2(sup 1)S 2.06 micrometer line emission in the central 45 inches of the Galactic Center is reported. The data gave new information on the energy production in the central parsec. Relatively narrow emission from nebular knots on the SgrA West ionized gas streamers, and a group of about a dozen compact, broad line HeI sources were found. Compact, broad line HeI sources are concluded to represent a cluster of late type, blue supergiants or Wolf-Rayet stars with heavy mass loss. The HeI emission comes from the extended atmospheres of these stars that have mass loss rates of a few 0.00001 to 0.0001 solar mass per year and outflow velocities of about 1000 km/s. The total mass outflow rate created by the central cluster is about 0.0003 solar mass per year. The high ratio of HeI/HI (Br(alpha), Br(gamma)) fluxes suggests an overabundance of helium in the atmospheres of these stars. The HeI stars are members of a cluster of massive stars that can account for the total luminosity, the flux of Lyman continuum photons, and the fairly low excitation of the central few parsecs. The data shows very clearly that massive star formation has taken place in the Galactic Center within the last few million years. ESA

N92-20465# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik.
FIRST OBSERVATIONS OF THE CO J = 6-5 TRANSITION IN STARBURST GALAXIES
A. I. Harris, R. E. Hills (Mullard Radio Astronomy Observatory, Cambridge, England), J. Stutzki, U. U. Graf, A. P. G. Russell, and R. Genzel Jul. 1991 21 p Submitted for publication
(MPE-Preprint-209; ETN-92-91017) Copyright Avail: NTIS HC/MF A03

The detection of carbon monoxide (CO) J=6-5 emission from the starburst nuclei of the galaxies, NGC253, M82, and IC342, is reported. The 6-5 transition was used as a thermometer of warm molecular gas in starburst nuclei, unambiguously finding that the nuclear molecular gas in starburst galaxies is substantially warmer than in typical disks clouds. Nuclear gas heating could be either large scale, for example turbulent motions or cloud-cloud collisions in noncircular bar orbits, more local effects of radiation from high mass star formation and supernovae, or some combination. High CO excitation temperatures can affect galactic nuclear mass estimates and consequently star formation efficiencies deduced from lower-J CO lines. ESA

N92-20508# Tuebingen Univ. (Germany, F.R.).
STATISTICAL INVESTIGATION OF THE AGN OBSERVATIONS OF THE X RAY SATELLITE EXOSAT Thesis [STATISTISCHE UNTERSUCHUNG VON AGN-BEOBACHTUNGEN DES ROENTGENSATELLITEN EXOSAT]
Volkmar Kuhnle Dec. 1990 136 p In GERMAN
(ETN-92-90638) Avail: NTIS HC/MF A07

Data from Active Galactic Nuclei (AGN) are examined using statistical methods. The most important model representations, with regard to AGN, are presented. X-ray astronomy and the meaning of statistical methods are discussed. The satellite is described. Conclusions based on the results are reported. ESA

N92-20509# Tuebingen Univ. (Germany, F.R.). Astronomisches Inst.
PREPARATION OF A SATELLITE EXPERIMENT FOR X RAY ASTRONOMY. DEVELOPMENT OF COMPUTATION PROGRAMS FOR THE CONTROL, AND DATA COLLECTION USING MC 6800 MOTOROLA MICROPROCESSOR Thesis [VORBEREITUNG EINES SATELLITENEXPERIMENTS ZUR ROENTGENASTRONOMIE. ENTWICKLUNG VON RECHNERPROGRAMMEN FUER DIE STEUERUNG UND DATENSAMMLUNG MIT DEM MIKROPROZESSOR]
Michael John Oct. 1984 100 p In GERMAN
(ETN-92-90639) Avail: NTIS HC/MF A05

For the Salyut HEXE experiment, a computation system was built in cooperation with the experimental computer of the German X-ray satellite ROSAT. The principles and the construction of the measuring instruments used are described. A short description of the X-ray observatory for the Salyut Space Station is given. In order to favor a better understanding of the data transmission of the phoswich detector, data transmission of the X-ray observatory using the detectors developed by West European institutes is presented. The telemetry of the HEXE experiment is explained. The described software was developed and tested for the HEXE experiment. An accurate representation of utilized processors is given. ESA

N92-20915 Pennsylvania Univ., Philadelphia.
ELLIPTICAL POLARIMETRY OF ELEVEN LUMINOUS LATE-TYPE VARIABLES Ph.D. Thesis
Bruce Douglas Holenstein 1991 320 p
Avail: Univ. Microfilms Order No. DA9200344

Instrumentation was developed to measure the normalized V Stokes vector coincident with the Q and U Stokes vectors of the filtered radiation field from a celestial source. The hybrid method developed to calibrate the system used null-polarization standards for the system offset and linear polarization standards along with a quarter-wave-plate-induced rotation on the Poincare sphere for the system gain. An observing program was completed that concentrated upon eleven luminous late-type variables (LLTV's). The program objects are 119 CE tau, alpha Ori, 6 BU Gem, psi(sup 1)Aur, 72 Leo, V CVn, alpha Sco, alpha(sup 1)Her, mu Cep, VV Cep, and beta Peg. The data for the program objects show circular polarization behavior that is as rich and as complex as was already known for the linear polarization. The infrared excesses of the the LLTV's were used to place useful limits on the dust shell particle numbers and masses. The calculations were accomplished by using the stellar flux at visible wavelengths to estimate and remove the stellar flux at infrared wavelengths. A Monte Carlo software model was developed to aid in the explanation of the observations. The model components include contributions from limb darkening, stellar spots, Rayleigh/Thomson scattering in the stellar atmosphere, Mie scattering from multiple particle types in the dust shell, and interstellar birefringence. The output of the software is an ensemble of maps which display the Stokes vectors and relative flux expected when looking at the modeled object from any direction. It was concluded that the linear polarization for most of the program objects arises from Rayleigh and Thomson scattering in the atmosphere of the objects and from single scattering by small silicate grains in the dust shells. The bulk of the circular polarization arises from three mechanisms: (1) single scattering of light linearly polarized in the stellar atmosphere and subsequently Mie scattered by spherical or irregularly-shaped aligned particles; (2) magneto-emission arising from spots; and (3) interstellar birefringence acting on an intrinsic stellar linear polarization. Dissert. Abstr.

N92-20948 Massachusetts Univ., Amherst.
A SPECTROSCOPIC STUDY OF THREE FU ORIONIS OBJECTS: ACCRETION DISKS AND WIND SIGNATURES Ph.D. Thesis
Alan David Welty 1991 145 p
Avail: Univ. Microfilms Order No. DA9120952

It has been suggested that in outburst, FU Ori objects (FUors) are luminous accretion disks surrounding young, low luminosity stars. We obtained high resolution, high signal-to-noise, 3985 to 4920 A, 4940 to 6830 A, and 8030 to 9510 A spectra of V1057 Cyg, Z CMa, and FU Ori at the Mayall telescope at the Kitt Peak National Observatory (KPNO) to examine predictions of the accretion disk model of Kenyon, Hartmann, and Hewett (1988). Given the simplicity of the model, we find suprising agreement between observed and synthetic spectra. We examine variation of absorption linewidth with the wavelength of synthetic and FUors spectra, and find good correlations for the model and two FUors. We also investigate variation of linewidth with lower excitation potential, and find a subtle effect, less useful as a disk diagnostic. Dissert. Abstr.

N92-20973# Lawrence Livermore National Lab., CA.
STRANGE STARS
C. Alcock 24 Sep. 1991 10 p Presented at the Workshop on Strange Quark Matter in Physics and Astrophysics, Aarhus (Denmark), 20-24 May 1991
(Contract W-7405-eng-48)
(DE92-007325; UCRL-JC-108483; CONF-9105243-3) Avail: NTIS HC/MF A02

The general structure of strange stars is reviewed, paying particular attention to their similarities to and differences from neutron stars. DOE

N92-20617* National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.
LESSONS LEARNED IN THE DEVELOPMENT OF THE HUBBLE SPACE TELESCOPE SOFTWARE
Michael Harrington, Frank VanLandingham, and William C. Schneider (Computer Sciences Corp., Calverton, MD.) *In* CNES, The Management of Large Software Projects in the Space Industry Jun. 1991 p 335-343 Previously announced in IAA as A91-47779 Prepared in cooperation with Aeritalia S.p.A., Turin, Italy (For primary document see N92-20589 11-61)
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90 ASTROPHYSICS

Includes cosmology; celestial mechanics; space plasmas; and interstellar and interplanetary gases and dust.
For related information see also *75 Plasma Physics*.

N92-20071*# Florida Inst. of Tech., Melbourne. Dept. of Mechanical and Aerospace Engineering.
RADIATION-INDUCED ROTATION OF SMALL CELESTIAL BODIES Final Report
N. Y. Misconi, John Oliver, and Roberto Mzariegos 17 Mar. 1992 38 p
(Grant NAG5-1497)
(NASA-CR-190085; NAS 1.26:190085) Avail: NTIS HC/MF A03 CSCL 03B

The rotation was studied of particles in a simulated space environment via a technique known as Laser Particle Levitation. The combination of both a high vacuum and optical laser levitation to negate the effects of Earth's gravity, simulate the space environment. The rotation mechanism under study is known as the 'Windmill Effect,' which is a spin mechanism that suggests that the interaction of the photon field from a star with the surface irregularities of cosmic dust will cause them to spin due to the imbalance in the directionality of the scattered photons which necessitates a non-zero angular momentum. This conclusion is based on the random nature of the orientation of the sites of surface irregularities. The general object is to study the behavior of particles in orbits around the Earth, both natural and man made, as well as interplanetary and circumstellar particles. To meet this objective, an apparatus was constructed which was designed to allow optical levitation in a vacuum. Author

N92-20213*# Toledo Univ., OH. Dept. of Physics and Astronomy.
LABORATORY ASTROPHYSICS UNDER THE ULTRAVIOLET, VISIBLE, AND GRAVITATIONAL ASTROPHYSICS RESEARCH PROGRAM: OSCILLATOR STRENGTHS FOR ULTRAVIOLET ATOMIC TRANSITIONS Annual Technical Report, 1 Mar. 1991 - 29 Feb. 1992
Steven R. Federman 29 Feb. 1992 14 p
(Grant NAGw-2457)
(NASA-CR-189900; NAS 1.26:189900) Avail: NTIS HC/MF A03 CSCL 03B

The conditions within astrophysical environments can be derived from observational data on atomic and molecular lines. For instance, the density and temperature of the gas are obtained from relative populations among energy levels. Information on populations comes about only when the correspondence between line strength and abundance is well determined. The conversion from line strength to abundance involves knowledge of meanlives and oscillator strengths. For many ultraviolet atomic transitions, unfortunately, the necessary data are either relatively imprecise or not available. Because of the need for more and better atomic oscillator strengths, our program was initiated. Through beam-foil spectroscopy, meanlives of ultraviolet atomic transitions are studied. In this technique, a nearly isotopically pure ion beam of the desired element is accelerated. The beam passes through a thin carbon foil (2 mg/cu cm), where neutralization, ionization, and excitation take place. The dominant process depends on the energy of the beam. Upon exiting the foil, the decay of excited states is monitored via single-photon-counting techniques. The resulting decay curve yields a meanlife. The oscillator strength is easily obtained from the meanlife when no other decay channels are presented. When other channels are present, additional measurements or theoretical calculations are performed in order to extract an oscillator strength. During the past year, three atomic systems have been studied experimentally and/or theoretically; they are Ar, I, Cl I, and N II. The results for the first two are important for studies of interstellar space, while the work on N II bears on processes occurring in planetary atmospheres. Author

N92-20239 Yale Univ., New Haven, CT.
NEUTRINO ASTROPHYSICS AND THE BIG BANG Ph.D. Thesis
Paul Romanelli 1991 178 p
Avail: Univ. Microfilms Order No. DA9136186

A detailed re-examination of primordial big-bang nucleosynthesis (BBN) is presented. This re-examination concentrates on the data for the main nuclear reactions leading to the production of Li-7, He-3 and D, and on the neutron half life, relevant for He-4 production. The new values for reaction rates and uncertainties are then used as input in a Monte Carlo analysis of big bang nucleosynthesis of light elements. This allows us to attach confidence levels to the predictions of the standard BBN model. Next we present a Monte Carlo study of supernova neutrinos in the Super-Kamiokande detector to determine the sensitivity of this detector to a tau neutrino mass. Using original and innovative energy and angular cuts, it is shown that Super-Kamiokande is sensitive in principle to a nu(sub r) mass as low as 25 eV for a supernova at 10 Kpc. Additionally, several aspects of supernova neutrino detection, which were mistated or misunderstood by previous authors, are clarified. Dissert. Abstr.

N92-20308# Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
GENERAL RELATIVISTIC CELESTIAL MECHANICS. PART 2: TRANSLATIONAL EQUATIONS OF MOTION
T. Damour, M. Soffel, and C. Xu Oct. 1991 81 p
(PB92-125020; IHES/P/91/72) Avail: NTIS HC/MF A05 CSCL 03A

The translation laws of motion for gravitationally interacting systems of N, arbitrarily composed and shaped, weakly self gravitating, rotating, deformable bodies are obtained at the first post-Newtonian approximation of general relativity. The derivation uses the authors' recently introduced multi-reference system method and obtains the translational laws of motion by writing that, in the local center of mass frame of each body, relativistic inertial effects combine with post-Newtonian self and externally generated gravitational forces to produce global equilibrium (relativistic generalization of d'Alembert's principle). Within the post-Newtonian approximation, i.e., neglecting terms of order v/c to the 4th power in the equations of motion, the authors' work is the first to obtain complete and explicit results, in the form of infinite series, for the laws of motion of arbitrarily composed and shaped bodies. The authors first obtain the laws of motion of each body as an infinite series exhibiting the coupling of all the (Blanchet-Damour) post-Newtonian multipole moments of the body to the post-Newtonian tidal moments felt by the body. Author

N92-20327 California Univ., Los Angeles.
GENERATION OF UPSTREAM ULF WAVES IN THE EARTH'S FORESHOCK Ph.D. Thesis
Guan Le 1991 248 p
Avail: Univ. Microfilms Order No. DA9129953

The Earth's foreshock is the region upstream from the bow shock in which the interplanetary magnetic field lines intersect the bow shock. It is characterized by backstreaming electrons and ions, and the associated upstream electrostatic and electromagnetic waves over a wide frequency range. Although the upstream phenomena were studied extensively since the 1970's, there are still many remaining problems which are not very well understood. Some of the questions related to the morphology of the ion foreshock and the properties of ULF waves which are mainly in the Earth's ion foreshock region are addressed. We take advantage of the multipoint measurements available from the ISEE, IMP-8, and the AMPTE spacecraft in the late 1970's and early 1980's to study the ion and ULF foreshocks as well as the underlying processes. We present the work of defining the compressional ULF foreshock boundary and studying the spatial variation of the ULF wave properties within the foreshock region experimentally. We discuss some recent studies of the properties of large amplitude compressional ULF waves in the ion foreshock region, including their bandwidth, coherence length, and associated pressure fluctuations, which are very important to the Earth's magnetosphere. We present our investigation of a new class of upstream ULF waves with period near 3 sec which occur upstream from both quasi-parallel and quasi-perpendicular shock, and are identified as the left-handed ion cyclotron waves propagating upstream. We compare one class of upstream ULF waves, discrete wave packets, with the similar wave phenomenon observed at comet Giacobini-Zinner, and conclude that their generation mechanism is similar too. Dissert. Abstr.

N92-20335 Texas Univ., Austin.
PROPAGATION OF UNCERTAINTIES IN GRAVITATIONAL SYSTEMS Ph.D. Thesis
Hak Jung Kim 1991 151 p
Avail: Univ. Microfilms Order No. DA9200651

The limits of dynamic system predictability for planetary system application are of great concern in celestial mechanics. Basic sources of prediction uncertainty include initial conditions, physical parameters, and mathematical models of the dynamical system as well as truncation and round-off due to numerical integration of the equations of motion. Methods are introduced to determine the evolution of probability densities and evaluate the propagation of uncertainties. Simple examples are presented to demonstrate these methods. The one-dimensional two-body problem is solved with Kolmogorov's equation. Density propagation is derived from the fundamental theorems of probability and applied to the two-body problem with successive mappings of regularized differential equations. Two numerical errors are modelled as stochastic processes. Tchebycheff inequality yields covariance matrix expressions of these errors in single-step integrators for ordinary differential equations. Three examples demonstrate that the error is initially manifested as arclength along the orbit obtained by numerical integration, which remains almost identical to the exact orbit. Subsequently, the numerically integrated orbit diverges from the exact orbit but retains the initial geometric shape. Uncertainties in initial conditions and physical parameters are modelled using a linear perturbation to propagate ensembles of trajectories. A new stochastic method is developed that combines error sources into a single Gaussian distribution as justified by the central limit theorem. This method is applied to the two-body problem and the restricted problem of three bodies. This study provides not only the error bounds in time but also the probability distributions within the bounds. Dissert. Abstr.

N92-20343# Los Alamos National Lab., NM.
NEUTRON STAR ACCRETION AND THE NEUTRINO FIREBALL
S. A. Colgate, M. E. Herant, and W. Benz (Arizona Univ., Tucson.) 26 Nov. 1991 11 p Presented at the Nuclear Astrophysics Symposium, Santa Cruz, CA, 8 Aug. 1991
(Contract W-7405-eng-36)
(DE92-005063; LA-UR-91-4005; CONF-9108187-1) Avail: NTIS HC/MF A03

The mixing necessary to explain the 'Fe' line widths and possibly the observed red shifts of 1987A is explained in terms of large scale, entropy conserving, up and down flows (calculated with a smooth particle 2-D code) taking place between the neutron star and the explosion shock wave due to the gravity and neutrino deposition. Depending upon conditions of entropy and mass flux, further accretion takes place in single events, similar to relaxation oscillator, fed by the downward flows of low entropy matter. The shock, in turn, is driven by the upflow of the buoyant high entropy bubbles. Some accretion events will reach a temperature high enough to create a neutrino 'fireball,' a region hot enough, 11 Mev, so as to be partially opaque to its own (neutrino) radiation. The continuing neutrino deposition drives the explosion shock until the entropy of matter flowing downwards onto the neutron star is high enough to prevent further accretion. This process should result in a robust supernova explosion. DOE

N92-20354*# Jet Propulsion Lab., California Inst. of Tech., Pasadena.
NEAR EARTH ASTEROID ORBIT PERTURBATION AND FRAGMENTATION
Thomas J. Ahrens (California Inst. of Tech., Pasadena.) and Alan W. Harris 18 Mar. 1992 21 p
(NASA-CR-190116; NAS 1.26:190116) Avail: NTIS HC/MF A03 CSCL 03B

Collisions by near earth asteroids or the nuclei of comets pose varying levels of threat to man. A relatively small object, approximately 100 meter diameter, which might be found on an impact trajectory with a populated region of the Earth, could potentially be diverted from an Earth impacting trajectory by mass driver rocket systems. For larger bodies, such systems would appear to be beyond current technology. For any size object, nuclear explosions appear to be more efficient, using either the prompt blow-off from neutron radiation, the impulse from ejecta of near-surface explosion for deflection, or as a fragmenting charge. Practical deflections of bodies with diameters of 0.1, 1, and 10 km require interception, years to decades prior to earth encounter, with explosions a few kilotons, megatons, or gigatons, respectively, of equivalent TNT energy to achieve orbital velocity changes or destruction to a level where fragments are dispersed to harmless spatial densities. Author

N92-20361 State Univ. of New York, Stony Brook.
STUDIES IN THE NUCLEAR ASTROPHYSICS OF TYPE 2 SUPERNOVAE Ph.D. Thesis
Maurice Bernard Aufderheide, III 1990 213 p
Avail: Univ. Microfilms Order No. DA9127573

Weak interactions in the presupernova evolution of large stars are discussed. Weak interactions set the timescales of the later burning stages of these stars and are important in setting the electron fraction per nucleon, and the average entropy, crucial quantities in core collapse calculations. The evolution of an 18 solar mass star is sketched, showing where these interactions have their effects and what nuclei have the largest role in the events. Current treatments of weak interactions, particularly electron capture and beta decay reactions, and their implementation in stellar evolution codes are discussed. Explosive nucleosynthesis after core collapse is also studied. Successful, independently verified, core collapse calculations have not yet been performed, and two methods of generating shock waves are typically used. In one approach, the temperature of a piece of the star is highly elevated, while in the other, a piece of the star is given a large outward velocity. In either case a shock wave is generated. It was found that the resulting peak temperature distributions are quite similar from the oxygen shell of the star outward.
Dissert. Abstr.

N92-20375 Edinburgh Univ. (Scotland).
MOLECULAR HYDROGEN LINE RATIOS AS PROBES OF SHOCKS IN DENSE CLOUDS Ph.D. Thesis
Alan Moorhouse 1990 186 p
Avail: Univ. Microfilms Order No. BRD-93911

Most of the work is based on a spectroscopic multi-line study of the near-infrared H2 emission on two sources, the Orion outflow and the supernova remnant IC443. In both sources it is found that planar hydrodynamic jump-type shocks (J) are consistent with the new observations. Planar magnetically moderated continuous shocks (C), which were invoked to explain the emission from the shock in Orion, are not. Neither shock types can explain the intensities of CO rotational lines and the H2 line ratios simultaneously. The high velocities that are observed still present a problem. In IC443 the conclusion is the same but, in addition, the pressure needed to explain the observations is higher than that observed in the supernova remnant. It is suggested that this discrepancy may naturally occur when radiative shocks are driven through a clumpy medium. This approach of using line ratios as shock discriminators is extended by velocity resolved spectroscopy of three highly excited emission lines from Orion. These observations demonstrate that there are no discernible differences in the line ratios with velocity despite the large change in the energies of the upper energy levels involved. It is discussed how this further constrains the shock type and limits the contribution from non-thermal excitation (such as fluorescence). The possible physical processes that could lead to high velocity, shocked molecular hydrogen are then discussed. It is then shown that the line ratios observed can be closely matched with non-planar continuous type shocks which occur in a bow shock. The densities and pressures needed are still high. The general conclusions are provided. Dissert. Abstr.

N92-20418# Los Alamos National Lab., NM.
WZ SGE: AN ACCRETION TEST CASE
W. M. Sparks, E. M. Sion, S. G. Starrfield, and S. Austin (Arizona State Univ., Tempe.) 1991 7 p Presented at the Workshop on Cataclysmic Variable Stars, Vina del Mar, Chile, 15-19 Jul. 1991
(Contract W-7405-eng-36)
(DE92-005062; LA-UR-91-4007; CONF-9107199-1) Avail: NTIS HC/MF A02

WZ Sge provides us with an excellent test for numerical codes trying to reproduce the heating and cooling of a white dwarf due to accreted material. This is because of both the many observed quantities of this binary and its long quiescent state. However, a large discrepancy appears between the observed white dwarf's cooling curve and calculated cooling curve from the deduced accreted mass. Possible causes for this discrepancy are discussed. DOE

N92-20420# Los Alamos National Lab., NM.
STAR-DISK COLLISIONS IN ACTIVE GALACTIC NUCLEI AND THE ORIGIN OF THE BROAD LINE REGION
W. H. Zurek, S. A. Colgate, and A. Siemiginowska (Harvard-Smithsonian Center for Astrophysics, Cambridge, MA.) Dec. 1991 5 p Presented at the Astrophysics Conference on Testing the AGN Paradigm, College Park, MD, Oct. 1991
(Contract W-7405-eng-36)
(DE92-005064; LA-UR-91-4003; CONF-9110315-1) Avail: NTIS HC/MF A01

Stars of a cluster surrounding the central black hole in an AGN will collide with the accretion disk. For a central black hole of 10(exp 8) solar mass and a cluster with 10(exp 7) - 10(exp 8) stars within a parsec, one estimates that approx. = 10(exp 4) such collisions will occur per year. Collisions are hypersonic (Mach number M much greater than 1). Some of the wake of the star (the disk material shocked by its passage) will follow it out of the disk. Such 'star tails' with the estimated masses (delta)m approx. = 10(exp 25) - 10(exp 27) g subsequently expand, cool and begin to recombine. We propose that, when illuminated by the ionizing flux from the central source, they are likely to be the origin of the observed broad emission lines. DOE

N92-20423# Los Alamos Naticnal Lab., NM.
TIDAL DISRUPTION OF A STAR BY A SUPERMASSIVE BLACK HOLE
P. Laguna, W. A. Miller, and W. H. Zurek 1991 5 p Presented at the Astrophysics Conference on Testing the AGN Paradigm, College Park, MD, Oct. 1991
(Contract W-7405-eng-36)
(DE92-005070; LA-UR-91-3920; CONF-9110315-2) Avail: NTIS HC/MF A01

The analysis of stars in galactic nuclei that are captured and tidally disrupted by a black hole of mass greater than 10(exp 6) solar mass requires the inclusion of general relativistic effects. We present the first numerical study of tidal breakup of a 1M (stellar mass) main sequence star by a 10(exp 7) M (stellar mass) black hole. We use a smoothed particle code to solve the hydrodynamic equations for a relativistic fluid in a static curved spacetime geometry to analyze, among other things, the fraction of the debris captured by the hole and the velocity of fragments escaping the hole. DOE

N92-20470 Iowa Univ., Iowa City.
NUMERICAL SIMULATION OF THE EMISSION AND MOTION OF NEUTRAL AND CHARGED DUST FROM P/HALLEY Ph.D. Thesis
Tracy Alan Ellis 1991 133 p
Avail: Univ. Microfilms Order No. DA9136921

A numerical model to predict the distributions of neutral or charged dust particles in P/Halley is presented. The spatial and temporal variations of the plasma parameters and magnetic field, which govern the charging and subsequent motion of dust, were included. In computing the electric charge of the dust particles, electron collection, photoemission, and secondary electron emission were taken into account. The trajectories of charged particles with radii less than about 0.1 micron (10 exp -14) were much different than those for neutral particles. By including temporal fluctuations, the maximum particle-nucleus distances along the Giotto, Vega 1, and Vega 2 trajectories were increased and made consistent with the measured values. Most of the model and in situ mass spectra were in good agreement except for a deficiency of the lowest mass model particles, and an offset in the total counting rate for two outbound mass spectra. The best agreement was obtained with a combination of two Lorentzian particle mass density functions with densities of 0.03-2.0 g/cc and 0.06-4.0 g/cc, and a ratio of 100:1 for the number of particles with the lower and higher density functions, respectively. Dust particle ejection velocities of about 1.7 times the theoretical dust-gas decoupling velocities were needed, as well as high secondary electron yield, and small particles which were more absorbing than large particles. Dissert. Abstr.

N92-20472 Iowa Univ., Iowa City.
RADIATIVE TRANSFER IN AXISYMMETRIC CIRCUMSTELLAR ENVELOPES Ph.D. Thesis
Alan J. Collison 1991 127 p
Avail: Univ. Microfilms Order No. DA9136910

During the late stages of stellar evolution, many stars undergo rapid mass loss. The mechanism which initiates the mass loss and the geometry of the outflow are as yet unknown. Most models of the resulting circumstellar envelopes assume a spherically symmetric outflow. However, the observational evidence increasingly points towards an axisymmetric distribution of emission (and hence mass) from these objects. To interpret the observations and to place more constraints on the theories for the mass loss, detailed models of circumstellar envelopes are needed for axisymmetric geometries. I develop modes of circumstellar dust shells which possess an axisymmetric distribution of dust. The transfer equation for the continuum is solved using an iterative technique. I then use these models to determine the resulting gas velocity structure and number density distribution in the envelope by assuming that the outflow is controlled by radiation pressure acting on the dust grains. Collisional and photodissociation of H2O in the outflow produces OH molecules. The escape probability formalism and a modified form of the Sobolev theory are used to

solve the equations of statistical equilibrium for the rotational level populations of OH. Line profiles are then computed for the 1612 MHz maser transition. From the continuum models I find that one-dimensional visibility measurements at 10 and 20 microns may be used to distinguish between 'donut-like' and 'disk-like' distributions of silicate dust grains. From the maser models I find that many of the characteristics of observed profiles are reproduced. I also find that a latitudinal velocity gradient plays a key role in the line transfer and may help explain some of the deficiencies of current models of circumstellar masers.
Dissert. Abstr.

N92-20477# Office National d'Etudes et de Recherches Aerospatiales, Paris (France).
ATMOSPHERIC TRANSMISSION OF POLAR METEORITES Ph.D. Thesis - Paris-Sud Univ.
Philippe Bonny 1991 221 p In FRENCH; ENGLISH summary
Translation was announced as ESA-TT-1283
(ONERA-NT-1991-5; ISSN-0078-3781; ETN-92-91026) Avail: NTIS HC/MF A10

The atmospheric transmission of polar micrometeorites, in the range 50 to 300 micrometers, is analyzed. Three main characteristics of polar micrometeorites are incompatible with predictions of previous models of micrometeorite atmospheric entry: the high fraction of unmelted particles, the low mass loss of those that are melted, and a still partly preserved organic matter as suggested by laboratory analysis. The purpose of the study is to understand how these cosmic grains make it through so unexpectedly well. The current theory is reviewed, considering both the aerodynamic field and the material thermal reaction field. A law of vaporization from a mixture of melted oxides is developed. The effect an organic component has on heating and the pyrolysis is analyzed with a computational code that simulates the entire process of ablation of a charforming material. A code was written to simulate the complete micrometeorite atmospheric entry trajectory, including melting, porosity change, loss of an organic component and vaporization of the major elements of the mineral component. The code is applied on the entire domain of micrometeorite velocity and angle of entry. The corridor of entry required for each of the three characteristics of the polar micrometeorites is evaluated. After weighting the angle and velocity allowed for each corridor, an entry velocity distribution compatible with actual polar micrometeorites characteristics is found by comparing computer-generated data with 'experimental'. The origin of the polar micrometeorites is discussed, considering the role they may have layed in bringing organic matter to the early Earth.
ESA

N92-20490*# Fermi National Accelerator Lab., Batavia, IL.
COULD THE ELECTROWEAK SCALE BE LINKED TO THE LARGE SCALE STRUCTURE OF THE UNIVERSE?
Alak Chakravorty (Chicago Univ., IL.) and Alessandro Massarotti Nov. 1991 7 p Sponsored in part by DOE
(Grant NAGw-2381)
(NASA-CR-190122; NAS 1.26:190122; FERMILAB-Pub-91/306-A) Avail: NTIS HC/MF A02 CSCL 03B

We study a model where the domain walls are generated through a cosmological phase transition involving a scalar field. We assume the existence of a coupling between the scalar field and dark matter and show that the interaction between domain walls and dark matter leads to an energy dependent reflection mechanism. For a simple Yakawa coupling, we find that the vacuum expectation value of the scalar field is theta approx. equals 30GeV - 1TeV, in order for the model to be successful in the formation of large scale 'pancake' structures.
Author

N92-20507# Tuebingen Univ. (Germany, F.R.). Fakultaet fuer Physik.
SEARCH OF SIGNATURES FOR PAIR PRODUCTION AND REFLECTION IN HIGH ENERGY X RAY SPECTRA OF ACTIVE GALAXIES Ph.D. Thesis [SUCHE NACH SIGNATUREN VON PAARERZEUGUNG UND REFLEXION IN HOCHENERGIE-ROENTGENSPEKTREN AKTIVER GALAXIEN]
Michael Maisack 1991 119 p In GERMAN
(ETN-92-90637) Avail: NTIS HC/MF A06

The observations of active galaxies, using the X-ray detector HEXE were evaluated, and the measured spectra were compared with the predictions of astrophysical plasma models. Particular attention was given to the effects of electron positron pair production by photon collision and reflection of a primary continuum on a colder matter, in particular an accretion disk. The objects considered were the quasar 3C 273, the Seifert galaxy NGC 4151 and the radiogalaxy CEN A. A joint evaluation, using data of the Japanese X-ray satellite GINGA showed that the share of a reflective component in the spectra of 3C 273 and NGC 4151 was very low. It was shown that only NGC 4151 could be described, using a pair cascade model.
ESA

N92-20903 Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences.
A UNIDIMENSIONAL MODEL FOR THE FORMATION OF MAGNETIC CAVITIES IN COMETS M.S. Thesis
Itzhak Klofman Oct. 1990 57 p In HEBREW; ENGLISH summary
(ITN-92-85151) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

In 1986, the Giotto spacecraft discovered a 4,700 km diameter, magnetic field-free region around Comet Halley. This region has been called the diamagnetic cavity and its boundary the contact surface. Various models have had some success in describing the cavity formation, but none has explained the two-peaked ion distribution, which includes a pile-up region and a spike near the cavity boundary. An energetic ion population, detected near the contact surface, has been suggested as a means of standing off the solar magnetic field. In the present work, a nonconstant velocity profile is integrated, in a self-consistent fashion, into a corrected Eviatar & Goldstein model, which adds the effects of thermal pressure, photoionization and recombination to ion-neutral friction effects. The model is based on two equations: the magnetic field momentum equation, and a continuity equation for the thermal ion density profile. The terms dealing with velocity derivatives were retained in order to maintain self-consistency.
ISA

N92-20904 Tel-Aviv Univ. (Israel). Dept. of Geophysics and Planetary Sciences.
LOW TEMPERATURE PROPERTIES OF ICE AND APPLICATIONS TO COMETS M.S. Thesis
Gila Notesco Oct. 1990 65 p In HEBREW; ENGLISH summary
(ITN-92-85152) Copyright Avail: Tel-Aviv Univ., Exact Sciences Library, Ramat Aviv 69978, Israel

The structure and thermal evolution of amorphous ice, trapping of gases in the ice, and their release from it have been studied. The release of gas from the ice during the transformation from amorphous to cubic structure, the transformation from cubic to hexagonal structure and the sublimation of ice were examined. It was found that the amount of gas remaining in the ice after the transformation to cubic structure depends linearly on the ice thickness. Reduction of the gas:water-vapor ratio in the deposition mixture, and thus the amount of gas trapped in the ice, caused a greater decrease in the amount of gas released during the amorphous to cubic transformation than during the cubic to hexagonal transformation and during sublimation. During the transformation from amorphous to cubic structure, part of the gas is released and part penetrates into deeper layers, even if these comprise mostly hexagonal ice. The gas is probably trapped in amorphous regions in those layers and is released during their transformation from the cubic to the hexagonal structure. The gas which is released during sublimation is apparently trapped during the deposition process. It is possible that part of this gas release is due to the decomposition of clathrate-hydrate. A large amount of frozen gas in the ice affects the ice structure during the deposition process, by preventing the formation of a closed structure. Thus, most of the gas is released during the

transformation from amorphous to cubic ice and from the cubic to the hexagonal structure. Author (ISA)

91 LUNAR AND PLANETARY EXPLORATION

Includes planetology; and manned and unmanned flights. For spacecraft design or space stations see *18 Spacecraft Design, Testing and Performance.*

N92-20505# Tuebingen Univ. (Germany, F.R.). Astronomisches Inst.
INTERACTION OF RADIATION WITH MATTER IN DUST ENVELOPES OF A PLANETARY NEBULA Thesis [WECHSELWIRKUNG VON STRAHLUNG MIT MATERIE IN STAUBHUELLEN PLANETARISCHER NEBEL]
Wolfgang Hopfensitz Nov. 1990 81 p In GERMAN
(ETN-92-90635) Avail: NTIS HC/MF A05

The good agreement of the observation results with models shows that the circumstellar dust envelope considered is the repulsed condensated envelope of the progenitor star. The dust distribution is orthogonal with regard to the considered bipolar morphology of the nebula. This distribution of matter is the starting point for the hydrodynamic development of the envelope. It is assumed that the planetary nebula morphology is realized by the interaction of two winds. Hydrodynamic simulations of the two wind model for a discoid envelope show that the quick wind at poles can break through by the shell. ESA

N92-20535*# Atmospheric and Environmental Research, Inc., Cambridge, MA.
EXTENDED ATMOSPHERES OF COMETS AND OUTER PLANET-SATELLITE SYSTEMS Final Report, 27 Jul. 1988 - 26 Jan. 1992
William H. Smyth and Max L. Marconi 30 Mar. 1992 47 p
Original contains color illustrations
(Contract NASw-4329)
(NASA-CR-190142; NAS 1.26:190142) Avail: NTIS HC/MF A03; 1 functional color page CSCL 03B

For the hydrogen coma of comet P/Halley, both a Lyman-alpha image and extensive Lyman-alpha scan data obtained by the Pioneer Venus Orbiter Ultraviolet spectrometer as well as H-alpha ground-based spectral observations obtained by the University of Wisconsin Space Physics Group were successfully interpreted and analyzed with our Monte Carlo particle trajectory model. The excellent fit of the model and the Halley data and the water production rate determined near perihelion (9 Feb. 1986) from 13 Dec. 1985 to 13 Jan. 1986 and from 1 Feb. to 7 Mar. 1986 are discussed. Studies for the circumplanetary distribution of atomic hydrogen in the Saturn and Neptune systems were undertaken for escape of H atoms from Titan and Triton, respectively. The discovery of a new mechanism which can dramatically change the normal cylindrically symmetric distribution of hydrogen about the planet is discussed. The implications for the Titan-Saturn and Triton-Neptune are summarized. Author

N92-20649# Tuebingen Univ. (Germany, F.R.). Astronomisches Inst.
HYDRODYNAMIC MODEL COMPUTATIONS FOR PLANETARY NEBULA Thesis [HYDRODYNAMISCHE MODELLRECHNUNGEN FUER PLANETARISCHE NEBEL]
Juergen Zweigle Jan. 1991 126 p In GERMAN
(ETN-92-90640) Avail: NTIS HC/MF A07

It is shown that the temporal development of a planetary nebula depends strongly on the selected initial model. Observations of various nebulae in different development stages are necessary in order to be able to compare the temporal development of a calculated planetary nebula with existing ones. Observations in all wavelength fields are of interest. In the initial stage the Red Giant Envelope (RGE) possesses a high proportion of dust and molecules, enabling it to be observed by radio and infrared measurements. When the RGE is ionized by the radiation of the central star, optical observations are possible. The theoretical treatment of the radiation emitted by the hot central star is considered. ESA

N92-20901*# Boeing Aerospace and Electronics Co., Huntsville, AL.
ROBOTIC LUNAR SURFACE OPERATIONS: ENGINEERING ANALYSIS FOR THE DESIGN, EMPLACEMENT, CHECKOUT AND PERFORMANCE OF ROBOTIC LUNAR SURFACE SYSTEMS
Gordon R. Woodcock 2 Jan. 1990 188 p
(Contract NAS2-12108)
(NASA-CR-189016; NAS 1.26:189016; D615-11901) Avail: NTIS HC/MF A09 CSCL 03B

The assembly, emplacement, checkout, operation, and maintenance of equipment on planetary surfaces are all part of expanding human presence out into the solar system. A single point design, a reference scenario, is presented for lunar base operations. An initial base, barely more than an output, which starts from nothing but then quickly grows to sustain people and produce rocket propellant. The study blended three efforts: conceptual design of all required surface systems; assessments of contemporary developments in robotics; and quantitative analyses of machine and human tasks, delivery and work schedules, and equipment reliability. What emerged was a new, integrated understanding of hot to make a lunar base happen. The overall goal of the concept developed was to maximize return, while minimizing cost and risk. The base concept uses solar power. Its primary industry is the production of liquid oxygen for propellant, which it extracts from native lunar regolith. Production supports four lander flights per year, and shuts down during the lunar nighttime while maintenance is performed. Author

N92-20926 California Inst. of Tech., Pasadena.
ONE. PHASE TRANSFORMATIONS AND THE SPECTRAL REFLECTANCE OF SOLID SULFUR: POSSIBLE METASTABLE SULFUR ALLOTROPES ON IO'S SURFACE. 2. PHOTOCHEMISTRY AND AEROSOL FORMATION IN NEPTUNE'S ATMOSPHERE Ph.D. Thesis
Julianne Ives Moses 1991 308 p
Avail: Univ. Microfilms Order No. DA9137270

Two papers are presented, and in the first one the spectral reflectance of elemental sulfur is examined in a set of laboratory experiments to determine the factors that affect the transformation rate of monoclinic (beta) sulfur and various other sulfur allotropes into orthorhombic (alpha) sulfur. The laboratory data have implications for the spectral variation and physical behavior of freshly solidified sulfur, if any exists, on Jupiter's satellite Io. Depending on its thermal history, molten sulfur on Io would initially solidify into a glassy solid or a monoclinic crystalline lattice; these forms might contain polymeric sulfur molecules as well as the more abundant S8 molecules. If freshly frozen sulfur on Io could lose heat rapidly and approach ambient dayside Io temperatures within several hours, then some of the metastable sulfur allotropes could be maintained on Io virtually indefinitely. Small droplets of sulfur ejected during plume eruptions might cool quickly enough to preserve these allotropes, but sulfur in large volcanic flows or lakes would probably remain warm long enough for phase transformations to proceed at a visible rate. The second paper involves the photodissociation of methane at high levels in Neptune's atmosphere leads to the production of more complex hydrocarbon species such as ethane, acetylene, methylacetylene, propane, diacetylene, ethylacetylene, and butane. These gases diffuse to the lower stratosphere where temperatures are low enough to allow all seven of the aforementioned species to condense. Particle formation may not occur readily, however, as the vapor species become supersaturated. We present a theoretical analysis of particle formation mechanisms at conditions relevant to Neptune's troposphere and stratosphere and show that hydrocarbon nucleation is very inefficient under Neptunian conditions: saturation ratios much greater than unity are required for aerosol formation by either heterogeneous, ion-induced, or homogeneous nucleation. Thus, stratospheric hazes may form far

below their saturation levels. We compare nucleation models with detailed atmospheric photochemical models in order to place realistic constraints on the altitude levels at which we expect hydrocarbon hazes or clouds to form on Neptune.
Dissert. Abstr.

N92-21006# Los Alamos National Lab., NM.
GAMMA RAY PRODUCTION CROSS SECTION FROM ENERGETIC NEUTRON INELASTIC SCATTERING FOR METHODICAL IMPROVEMENTS IN PLANETARY GAMMA RAY SPECTROSCOPY
C. M. Castaneda, R. Gearhart, B. Sanii, P. A. J. Englert (San Jose State Univ., CA.), D. M. Drake, and R. C. Reedy 1991 11 p Presented at the International Topical Conference on Methods and Applications of Radioanalytical Chemistry 2 (MARC-2), Kona, HI, 21-27 Apr. 1991
(Contract W-7405-eng-36)
(DE92-007411; LA-UR-92-258; CONF-910422-7) Avail: NTIS HC/MF A03

Planetary gamma ray spectroscopy can be used to chemically analyze the top soil from planets in future planetary missions. The production from inelastic neutron interaction plays an effective role in the determination on the C and H at the surface. The gamma ray production cross section from the strongest lines excited in the neutron bombardment of Fe have been measured by the use of a time analyzed quasi-mono-energetic neutron beam and a high purity germanium detector. The results from En = 6.5, 32, 43, and 65 MeV are presented. DOE

92 SOLAR PHYSICS

Includes solar activity, solar flares, solar radiation and sunspots.

For related information see *93 Space Radiation.*

N92-20050# Midwest Research Inst., Golden, CO.
MEASUREMENT AND ANALYSIS OF NEAR ULTRAVIOLET SOLAR RADIATION
M. S. Mehos, K. A. Pacheco, and H. F. Link Dec. 1991 7 p Presented at the 1992 ASME-JSES-KSES International Solar Energy Conference, Maui, HI, 4-8 Apr. 1992
(Contract DE-AC02-83CH-10093)
(DE92-001181; NREL/TP-253-4493; CONF-920436-8) Avail: NTIS HC/MF A02

The photocatalytic detoxification of organic contaminants is currently being investigated by a number of laboratories, universities, and institutions throughout the world. The photocatalytic oxidation process requires that contaminants come in contact with a photocatalyst such as titanium dioxide, under illumination of ultraviolet (UV) radiation in order for the decomposition reaction to take place. Researches from the National Renewable Energy Laboratory (NREL) and Sandia National Laboratories are currently investigating the use of solar energy as a means of driving this photocatalytic process. Measurements of direct-normal and global horizontal ultraviolet (280 to 385 nm) and full spectrum (280 to 4000 nm) solar radiation taken in Golden, Colorado over a one-year period are analyzed, and comparisons are made with data generated from a clear sky solar radiation model (BRITE) currently in use for predicting the performance of solar detoxification processes. Analysis of the data indicates a ratio of global horizontal ultraviolet to full spectrum radiation of 4 to 6 pct. that is weakly dependent on air mass. Conversely, data for direct normal ultraviolet radiation indicate a much larger dependence on air mass, with a ratio of approx. 5 pct. at low air mass to 1 pct. at higher masses. Results show excellent agreement between the measured data and clear sky predictions for both the ultraviolet and the full spectrum global horizontal radiation. For the direct normal components, however, the tendency is for the clear sky model to underpredict the measured data. Averaged monthly ultraviolet radiation available for the detoxification process indicates that the global horizontal component of the radiation exceeds the direct normal component throughout the year. DOE

N92-20502# Technische Univ., Munich (Germany, F.R.). Fakultaet fuer Physik.
EXAMINATIONS OF THE PRACTICABILITY OF THE GEOCHEMICAL Tl-205 SOLAR NEUTRINO Ph.D. Thesis [UNTERSUCHUNGEN ZUR DURCHFUEHRBARKEIT DES GEOCHEMISCHEN 205 TL-SONNENNEUTRINO-EXPERIMENTS]
Stefan Neumaier 1990 135 p In GERMAN
(ETN-92-90632) Avail: NTIS HC/MF A07

It is shown that the practicability of the Tl-205 solar neutrino experiment depends in Tl-205 neutrino capture rate, and on the underground in which it is set as a detector for thallium deposit. The neutrino capture rate for the first excited state of Pb-205 was calculated to 214 Standard Neutrino Units (SNUs). The contributions of higher excited states to Tl-205 neutrino capture rates was determined. The total neutrino capture rate, in the framework of the standard sum model, amounts to 260 SNU. The influence of neutrino oscillations in matter and in vacuum on the neutrino capture rate of the Tl-205 experiment is discussed in connection with the transfers to high excited states of Pb-205.
ESA

N92-20518*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE 1988 SOLAR MAXIMUM MISSION EVENT LIST
B. R. Dennis, J. P. Licata, and A. K. Tolbert (ST Systems Corp., Lanham, MD.) Feb. 1992 352 p
(NASA-TM-4343; Rept-92B00039; NAS 1.15:4343) Avail: NTIS HC/MF A16 CSCL 03B

Information on solar burst and transient activity observed by the Solar Maximum Mission (SMM) during 1988 pointed observations is presented. Data from the following SMM experiments are included: (1) gamma ray spectrometer; (2) hard x ray burst spectrometer; (3) flat crystal spectrometers; (4) bent crystal spectrometer; (5) ultraviolet spectrometer polarimeter; and (6) coronagraph/polarimeter. Correlative optical, radio, and Geostationary Operational Environmental Satellite (GOES) x ray data are also presented. Where possible, bursts, or transients observed in the various wavelengths were grouped into discrete flare events identified by unique event numbers. Each event carries a qualifier denoting the quality or completeness of the observation. Spacecraft pointing coordinates and flare site angular displacement values from sun center are also included. Author

N92-20536# National Geophysical Data Center, Boulder, CO.
SOLAR-GEOPHYSICAL DATA NUMBER 563, JULY 1991. PART 1 (PROMPT REPORTS): DATA FOR JUNE, MAY 1991, AND LATE DATA
H. E. Coffey Jul. 1991 169 p
(PB91-241414; SGD-563-Pt-1) Avail: NTIS HC/MF A08 CSCL 03B

Solar-geophysical data is presented in tables and graphs. A detailed index of 1990-1991 events is included. Data for May 1991 shows solar active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, and geomagnetic indices. Data for June of 1991 presents solar-terrestrial environment, solar activity indices, solar flares, solar radio emission, and Stanford mean solar magnetic field information. Also, late data is given for April 1991 on geomagnetic indices and provisional values of hourly equatorial DST from June to December of 1990. GRA

N92-20538*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, MD.
THE 1984 - 1987 SOLAR MAXIMUM MISSION EVENT LIST
B. R. Dennis, J. P. Licata, J. J. Nelson, and A. K. Tolbert (ST Systems Corp., Lanham, MD.) Feb. 1992 286 p
(NASA-TM-4342; Rept-92B00038; NAS 1.15:4342) Avail: NTIS HC/MF A13 CSCL 03B

Information on solar burst and transient activity observed by the Solar Maximum Mission (SMM) during 1984-1987 pointed observations is presented. Data from the following SMM experiments are included: (1) gamma ray spectrometer; (2) hard

x-ray burst spectrometer; (3) flat crystal spectrometer; (4) bent crystal spectrometer; (5) ultraviolet spectrometer polarimeter; and (6) coronograph/polarimeter. Correlative optical, radio, and Geostationary Operational Environmental Satellite (GOES) x ray data are also presented. Where possible, bursts or transients observed in the various wavelengths were grouped into discrete flare events identified by unique event numbers. Each event carries a qualifier denoting the quality or completeness of the observations. Spacecraft pointing coordinates and flare site angular displacement values from sun center are also included. Author

N92-20539# National Geophysical Data Center, Boulder, CO.
SOLAR-GEOPHYSICAL DATA NUMBER 563, JULY 1991. PART 2 (COMPREHENSIVE REPORTS): DATA FOR JANUARY 1991 AND MISCELLANEOUS
H. E. Coffey Jul. 1991 113 p
(PB91-241422; SGD-563-Pt-2) Avail: NTIS HC/MF A06 CSCL 03B

Solar-geophysical data is presented in tables and graphs. A detailed index of events for 1990-1991 is given. Data for January 1991 on solar flares, solar radio bursts at fixed frequencies, solar x ray radiation from geostationary operational environment satellite (GOES), mass ejections from the sun, active prominences, and filaments is shown. Also, miscellaneous data on major solar proton events between 1955 and 1986 is shown. GRA

N92-20544# National Geophysical Data Center, Boulder, CO.
SOLAR-GEOPHYSICAL DATA NUMBER 565, SEPTEMBER 1991. PART 1 (PROMPT REPORTS): DATA FOR AUGUST, JULY 1991, AND LATE DATA
H. E. Coffey Sep. 1991 177 p
(PB92-119080; SGD-565-Pt-1) Avail: NTIS HC/MF A09 CSCL 03B

Solar-geophysical data is presented in tables and graphs. A detailed list of events is given for 1991. Data for August 1991 on solar-terrestrial environment, solar activity indices, solar flares, solar radio emission, and Stanford mean solar magnetic field is shown. Data for July 1991 on solar active regions, sudden ionospheric disturbances, solar radio spectral observations, cosmic ray measurements by neutron monitor, and geomagnetic indices is shown. Also, late data on solar radio emission for May to July 1991 and cosmic ray measurements by neutron monitor for June 1991 are presented. GRA

N92-20661*# Alabama Univ., Huntsville. Dept. of Physics.
DATA ACQUISITION AND ANALYSIS: SOLAR VECTOR MAGNETOSPHERE Final Report, Aug. - Dec. 1991
A. Gordon Emslie Feb. 1992 4 p
(Contract NAS8-38609)
(NASA-CR-184298; NAS 1.26:184298; Rept-1F) Avail: NTIS HC/MF A01 CSCL 03B

Magnetic shear was observed in several active regions prior to flaring activity. However, certain flares were observed with no apparent shear present. A more detailed investigation of such events is required. Author

N92-20823# National Geophysical Data Center, Boulder, CO.
SOLAR-GEOPHYSICAL DATA NUMBER 565, SEPTEMBER 1991. PART 2 (COMPREHENSIVE REPORTS): DATA FOR MARCH 1991 AND MISCELLANEOUS
H. E. Coffey Sep. 1991 179 p
(PB92-119098; SGD-565-Pt-2) Avail: NTIS HC/MF A09 CSCL 03B

A detailed index for 1991 is presented. Data is shown in tables and graphs for March 1991 on: solar radio bursts at fixed frequencies; interplanetary solar particles and plasma; solar wind; solar x ray radiation; mass ejection from the sun; active prominences and filaments; and solar irradiance. GRA

N92-20912 California Inst. of Tech., Pasadena.
FREQUENCIES AND AMPLITUDES OF HIGH-DEGREE SOLAR OSCILLATIONS Ph.D. Thesis
James Morris Kaufman 1991 153 p
Avail: Univ. Microfilms Order No. DA9137249

Measurements of some of the properties of high-degree solar p- and f-mode oscillations are presented. Using high-resolution velocity images from Big Bear Solar Observatory, we have measured mode frequencies, which provide information about the composition and internal structure of the Sun, and mode velocity amplitudes (corrected for the effects of atmospheric seeing), which tell us about the oscillation excitation and damping mechanisms. We present a new and more accurate table of the Sun's acoustic vibration frequencies, nu(sub nl), as a function of radial order n and spherical harmonic degree l. These frequencies are averages over azimuthal order m and approximate the normal mode frequencies of a nonrotating spherically symmetric Sun near solar minimum. The frequencies presented here are for solar p- and f-modes with 180 less than or = l less than or = 1920, 0 less than or = n less than or = 8, and 1.7 mHz less than or = nu(sub nl) less than or = 5.3 mHz. The uncertainties, sigma(sub nl), in the frequencies areas are as low as 3.1 micro-Hz. The theoretically expected f-mode frequencies are given by omega squared = gk(sub h) approx. = gl/R, where g is the gravitational acceleration at the surface, k(sub h) is the horizontal component of the wave vector, and R is the radius of the Sun. We find that the observed frequencies are significantly less than expected for l greater than 1000, for which we have no explanation. Observations of high-degree oscillations, which have very small spatial features, suffer from the effects of atmospheric image blurring and image motion (or 'seeing'), thereby reducing the amplitudes of their spatial-frequency components. In an attempt to correct the velocity amplitudes for these effects, we simultaneously measured the atmospheric modulation transfer function (MTF) by looking at the effects of seeing on the solar limb. We are able to correct the velocity amplitudes using the MTF out to l approx. = 1200. We find that the frequency of the peak velocity power (as a function of l) increases with l. We also find that the mode energy is approx. constant out to l approx. = 200. Mode energy is expected to be constant as a function of l if the modes are excited by stochastic interactions with convective turbulence in the solar convection zone. The accuracy of the seeing correction and a test of the correction using the 7 Mar. 1989 partial solar eclipse are discussed. Dissert. Abstr.

N92-20916*# Stanford Univ., CA. Center for Space Science and Astrophysics.
SEARCH FOR EVIDENCE OF A CLOCK RELATED TO THE SOLAR 154 DAY COMPLEX OF PERIODICITIES
P. A. Sturrock and T. Bai 17 Mar. 1992 34 p Submitted for publication
(Grant NAGw-2265)
(NASA-CR-190156; NAS 1.26:190156) Avail: NTIS HC/MF A03 CSCL 03B

Evidence that has recently been compiled (Bai and Sturrock 1991) indicates that the enigmatic 154-day periodicity in solar activity may be viewed as part of a complex of periodicities that are approximate multiples of 25.8 days, suggesting that the Sun contains a 'clock' with frequency in the range 440 to 463 nano Hz. The clock may comprise either an oscillator or a rotator, each of which may be either real or virtual. We have reconsidered a previous spectrum analysis of the Zurich sunspot-number sequence by Knight, Schatten, and Sturrock (1979) which revealed a sharp, persistent and significant periodicity with a period of 12.072 days, corresponding to a frequency of about 958.8 nano Hz. This periodicity may be regarded as the (second) upper sideband of the second harmonic (2nu(sub R) + 2nu(sub E)) of a fundamental frequency of 447.7 nano Hz that is clearly within the search band. In this expression, nu(sub R) is the sidereal frequency of the hypothetical rotator and nu(sub E) is the frequency (31.69 nano Hz) of the Earth in its orbital motion around the Sun. In analyzing sunspot area data derived from the Greenwich data set, and on noting that any frequency is defined only to within the Nyquist frequency, we find clear evidence not only for the upper sideband of the second harmonic, but also for the second harmonic (2nu(sub R)) and the lower sideband of the second harmonic (2nu(sub R) -

2nu(sub E)). There is no strong peak at the fundamental frequency in the Greenwich data, but there is in the Zurich sunspot data. The effect of a linear oscillator is, to the lowest order in the amplitude, the same as the combined effect of two rotators of opposite polarities. A rotator that has arbitrary orientation with respect to the ecliptic may influence the outer layers of the Sun and thereby modulate the occurrence of solar activity such as sunspots. By analyzing a simple model, we find that such a rotator would influence surface activity in such a way that the spectrum of a 'signal' (such as the record of sunspots), as seen from the Earth, would contain components with frequencies that are certain integral combinations of nu(sub R) and nu(sub E). The amplitudes of the various components depend sensitively on theta, the angle between the axis of the rotator and the axis of the Earth's orbital motion. This simple model therefore offers a kinematical (but not dynamical) interpretation of the sunspot spectrum. The present analysis, while offering support of our conjectures that the Sun contains a clock that regulates the 154-day complex of periodicities, cannot distinguish between an osillator or a rotator (that might be a traveling wave), nor between a real rotator or a virtual rotator (that might be an apparent traveling wave due to the aliasing effect of an oscillator in a rotating system). Further analysis of sunspot and other data sets will be required to confirm the existence of such clock and (if it is real) to determine its physical nature.
Author

N92-21069# Los Alamos National Lab., NM.
SOLAR WIND THERMAL ELECTRON DISTRIBUTIONS
J. L. Phillips and J. T. Gosling 1991 15 p Presented at the 7th Solar Wind Conference, Goslar (Germany), 16-21 Sep. 1991
(Contract W-7405-eng-36)
(DE92-003854; LA-UR-91-3578; CONF-910915-5) Avail: NTIS HC/MF A03

Solar wind thermal electron distributions exhibit distinctive trends which suggest Coulomb collisions and geometric expansion in the interplanetary magnetic field play keys roles in electron transport. We introduce a simple numerical model incorporating these mechanisms, discuss the ramifications of model results, and assess the validity of the model in terms of ISEE-3 and Ulysses observations. Although the model duplicates the shape of the electron distributions, and explains certain other observational features, observed gradients in total electron temperature indicate the importance of additional heating mechanisms. DOE

93 SPACE RADIATION

Includes cosmic radiation; and inner and outer earth's radiation belts.

For biological effects of radiation see *52 Aerospace Medicine*. For theory see *73 Nuclear and High-Energy Physics*.

N92-20106 Louisiana State Univ., Baton Rouge.
MEASUREMENT OF GALACTIC COSMIC RAY PROTON AND HELIUM SPECTRA DURING THE 1987 SOLAR MINIMUM Ph.D. Thesis
Eun-Suk Seo 1991 135 p
Avail: Univ. Microfilms Order No. DA9200090

The differential cosmic ray proton and helium spectra were measured during the 1987 solar minimum using a balloon-borne superconducting magnetic spectrometer launched from Prince Albert, Canada. The changing geomagnetic cutoff along the balloon trajectory was observed in the low energy proton data to be about 25 percent below the normal calculated values. The measured particle fluxes were approximately equal to the highest fluxes observed at the previous solar minimum in 1977. Above 10 GV the observed spectra are represented by a power law in rigidity with spectral indices of 2.74 +/- 0.02 for protons and 2.68 +/- 0.03 for helium. The measurements above 200 MeV/nucleon are consistent with rigidity power law interstellar spectra modulated with the solar modulation parameter phi = 500 MV. The energy dependence of the proton to helium ratio is consistent with rigidity power law injection spectra and rigidity-dependent propagation without re-acceleration. Dissert. Abstr.

N92-20202# Oak Ridge National Lab., TN.
AN OVERVIEW OF THE QADS CODE
B. L. Broadhead 1991 13 p Presented at the Seminar on SCALE-4 and Related Modular Systems for the Evaluation of Nuclear Fuel Facilities and Package Design Featuring Criticality, Shielding and Heat Transfer Capabilities, Gif-sur-Yvette (France), 17-20 Sep. 1991
(Contract DE-AC05-84OR-21400)
(DE92-005124; CONF-9109217-4) Avail: NTIS HC/MF A03

QADS is a module that performs multidimensional point-kernel estimation of gamma transport through practically any type of shielding material via a simplified input scheme that follows the general input philosophy of the SCALE shielding sequences SAS1, SAS2, and SAS4. This paper presents a general overview of the theory and input requirements for QADS. DOE

N92-20311 Michigan Univ., Ann Arbor.
COSMIC RAY SPECTROMETRY WITH A SUPERCONDUCTING MAGNET Ph.D. Thesis
Shawn Patrick McKee 1991 308 p
Avail: Univ. Microfilms Order No. DA9135653

The Superconducting Magnet Instrument for Light Isotopes (SMILI) balloon borne cosmic ray instrument is described, including its design, testing, and flight. The helium isotope results from 100-500 MeV/nucleon are presented and discussed. A flux calculation indicates that the solar modulation parameter during the summer of 1989 was given by phi = 1600 +/- 75 MV. This large value of phi allowed SMILI to sample a much higher energy region in interstellar space than similar experiments flown during solar minimum. The ratio of He-3/He-4 measured by SMILI from 100-1100 MeV/nucleon is rising slightly at earth's orbit. Corrections to interstellar space are made assuming an interstellar momentum spectrum of He-4 which varies as AP(exp gamma) with gamma = -2.2, P being the momentum, and A a normalization factor. A momentum spectral index for He-3 of approximately gamma = -2.4 fits our data the best. The SMILI data, after modulation to 500 MV, is in agreement with the predictions of an energy dependent pathlength distribution derived from the B/C abundance ratio. SMILI is the first experiment to confirm the predictions for the rise in the isotopic ratio of He-3/He-4 in the GeV/n region. There is no evidence in the SMILI data that the propagation history of helium is different from CNO. A re-flight of SMILI is planned for the summer of 1991 to verify and extend these results.
Dissert. Abstr.

N92-20405 Columbia Univ., New York, NY.
OBSERVATIONS OF THE COSMIC X RAY BACKGROUND BELOW 4 keV Ph.D. Thesis
Xiaoyi Wu 1990 82 p
Avail: Univ. Microfilms Order No. DA9128009

The first measurement of the intensity and spectrum of the diffuse X-ray background in the 0.16-3.5 keV band which is free from contamination by sources with fluxes greater than approximately 4 x 10(exp -14)erg cm(exp -2)s(exp -1) is reported. This result was made possible by the development of a number of techniques for removing cosmic ray contamination and instrumental artifacts in the data collected by the Einstein Observatory Imaging Proportional Counter (IPC). Our analysis of the background data reveals a mean absolute intensity for the emission I(sub x)(0.16-3.5 keV) is approximately 2.5 x 10(exp -8)erg cm(exp -2)s(exp -1)ster(exp -1). The intensity is dependent on galactic longitude even when only high galactic latitude data are used, allowing us to set a lower limit on the galactic contribution to the emission in this band. The spectrum of the total background is consistent with a power law of slope approximately 0.7 between 0.5 keV and 3.5 keV with a steep rise toward lower energies. Additionally, a reanalysis of the Einstein Observatory data is presented in order to determine the contribution of detected, discrete sources of X-ray emission to the cosmic X-ray background.

A total of 33 sources were found in a region of approximately 3.3 deg(exp 2) down to a minimum flux threshold of 4 x 10(exp -14)erg cm(exp -2)s(exp -1) in the 0.3-3.5 keV band. Roughly 30 percent of the objects are foreground stars, leading to an extragalactic source surface density of 7 x 10(exp 4)sr(exp -1) at this threshold. The integrated contribution from discrete sources to the cosmic X-ray background measured in this same band with the same instrument is 12 +/- 3 percent. Finally, all-sky maps of diffuse X-ray emission in nine energy bands are presented. Galactic features in both emission and absorption are present, providing information on the fraction of the total diffuse emission in each band which is galactic in origin. Dissert. Abstr.

N92-20416# Los Alamos National Lab., NM.
GAMMA-RAY BURST DATA FROM DMSP SATELLITES
J. Terrell, R. W. Klebesadel, P. Lee, and J. W. Griffee (Sandia National Labs., Albuquerque, NM.) 1991 6 p Presented at the Gamma Ray Burst Conference, Huntsville, AL, 17-18 Oct. 1991
(Contract W-7405-eng-36)
(DE92-005061; LA-UR-91-4034; CONF-9110310-2) Avail: NTIS HC/MF A02

A number of gamma ray bursts have been detected by means of gamma ray detectors aboard three Air Force Defense Meteorological Satellite Program (DMSP) satellites, in polar orbits at 800 km altitude. The gamma ray data have a 2 second resolving time, and are usually telemetered in 5 energy bins in the range 50 to 1000 keV. Although it is not possible to detect gamma ray bursts when the DMSP satellites are passing through the radiation belt or the South Atlantic Anomaly, or when the source is obscured by the Earth, a number of gamma ray bursts have been detected by two or even three of the satellites. The DMSP data may be of considerable assistance in evaluating time histories, locations, and spectra of gamma ray bursts. DOE

N92-20464# Max-Planck-Inst. fuer Physik und Astrophysik, Garching (Germany, F.R.). Inst. fuer Extraterrestrische Physik.
EVOLUTIONARY SYNTHESIS OF THE RADIO AND FAR INFRARED EMISSION IN STARBURSTS
J. Miguel Mas-Hesse (Universidad Complutense, Madrid, Spain) Jul. 1991 26 p Submitted for publication Sponsored by ESA and DGICYT
(MPE-Preprint-207; ETN-92-91016) Copyright Avail: NTIS HC/MF A03

The correletion between the radio and far infrared luminosities in a sample of 230 objects with active star formation (H II regions, blue compact galaxies, and spiral galaxies) were reanalyzed. The correlation extends to the low luminosity end, holding over more than 7 decades. The dispersion in the ratio (R) between radio and far infrared emission is always within a factor 4, but different classes of objects show significant differences in R, which is lowest for H II regions and highest for interacting spirals and Blue Compact Dwarf Galaxies (BCDG's). Simple evolutionary synthesis models can reproduce generally well the observed values of R and of the radio spectral index. The thermal radio excess found in LMC (Lower Magellanic Cloud) H II regions and BCDG's suggests that the ionizing flux emitted by a metal deficient cluster of young massive stars is significantly higher than at solar metallicities. In spiral galaxies, it is assumed that the nonthermal radio emission is between one and two orders of magnitude higher than the emission expected from single isolated supernova remnants, indicating that supernova explosions would have to inject a larger amount of energy to cosmic rays electrons than previously thought. ESA

N92-20503# Wuppertal Univ. (Germany, F.R.). Fachbereich Physik.
INVESTIGATION OF ISOTROPY OF THE COSMIC RADIATION FOR ENERGIES GREATER THAN 10 TO THE 13TH POWER eV WITH THE FREJUS UNDERGROUND DETECTOR Ph.D. Thesis [UNTERSUCHUNG DER ISOTROPIE DER KOSMISCHEN STRAHLUNG BEI ENERGIEN GREATER THAN 10 TO THE 13TH POWER EV MIT DEM FREJUS-UNTERGRUNDDETEKTOR]
Michael Schubnell Feb. 1990 117 p In GERMAN; ENGLISH summary
(WUB-DIS-90-1; ETN-92-90633) Avail: NTIS HC/MF A06

The complete muon data from the Frejus underground detector recorded during years 1984 to 1988 are analyzed. The good calorimetric resolution of the detector is used to measure the spectral index of the muons underground. Deviations are searched in time, space and spectrum of the isotropic primary cosmic ray flux. No significant deviations from the expected isotropic flux are found in the muon data underground, neither in time nor in space, or spectrum. Looking at point sources, the analysis yields upper limits on a possible excess muon flux, from the direction of Cygmus X3, Hercule X1, the Crab nebula and SN 1987a. ESA

N92-20859 Rice Univ., Houston, TX.
AURORAL ELECTRODYNAMICS FROM SIMULTANEOUS MEASUREMENTS AT HIGH AND LOW ALTITUDES Ph.D. Thesis
Gang Lu 1991 127 p
Avail: Univ. Microfilms Order No. DA9136046

Two auroras sampled nearly simultaneously at high and low altitudes along a field line by the Dynamics Explorer (DE) spacecraft were used to study auroral electrodynamics. Electric fields plotted as a function of invariant latitude show that the large-scale features are essentially the same at high and low altitudes outside the auroral acceleration region. Parallel electric fields associated with parallel currents are such as to filter the small-scale structure in the high altitude electric field pattern. From the magnetic field measurements, we find that there is a return current region embedded between two auroral arc structures. The latitude shift between the high-altitude and low-altitude return current regions indicates that the auroral arcs are moving equatorward with a velocity of about 250 m/s. Collisionless plasma kinetic theory was used to predict the relationship between the upward parallel current and the parallel potential drop. The DE 1/DE 2 pair offers a unique opportunity to test this relationship because the DE 1 spacecraft can measure high altitude plasma parameters without contamination from auroral heating. Using measured values of J(parallel) (mapped to the surface) and phi(parallel), the ratio of J(parallel)/ e(phi)(parallel) varies considerably but with a mean value of about 0.5 to approximately 2.2 x 10(exp -9) mho/sq m. Suprathermal electron bursts are also observed in the diffuse aurora at the same invariant latitudes, both at high and at low altitudes. Thus, we suggest that these 'bursts' are more properly described as a spatial rather than temporal phenomenon. Observations of upflowing ionospheric ions are obtained by both DE 1 and DE 2 over the nightside auroral regions. At low altitudes, the mean value of the net upward ion number flux is of the order of 10(exp 9)/(cc x sec). The ionosphere is predominantly O(+), and the ions with energies greater than 5 eV are a only very small fraction of the total ion population. At high altitudes, the upflowing ions are accelerated and heated. Comparing upflowing fluxes at high and low altitudes yields an estimated height of the bottom of the auroral acceleration region of 1100-1400 km. Author

99 GENERAL

N92-20790# National Inst. of Standards and Technology, Gaithersburg, MD.
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The following subject areas are covered: a high-temperature transient hot-wire thermal conductivity apparatus for fluids; standard reference specimens in quality control of engineering surfaces; an automated reverse-bias second-breakdown transistor tester; high

resolution synchroton X-radiation diffraction imaging of crystals grown in microgravity and closely related terrestrial crystals; root projection of one-sided time series; and deconvolution of acoustic emission and other causal time series. GRA

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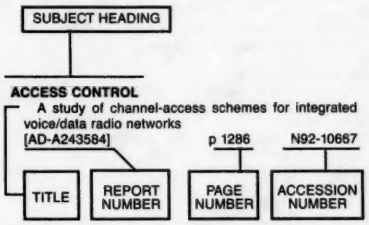
Typical Subject Index Listing



The subject heading is a key to the subject content of the document. Titles, report numbers, and accession numbers of pertinent documents are provided under each subject heading. When the title is insufficiently descriptive of the document content, a title extension has been added, separated from the title by three hyphens. The report number helps to indicate the type of document cited (e.g., NASA report, NASA translation, NASA contractor report). The accession number is the number by which the document abstracts are arranged in this journal and by which the document is sold or requested. The page number helps you locate the the citation in the abstract section. The titles, with title extensions if present, are arranged under each subject heading in ascending accession number order. The subject headings have been selected from the latest revision of the *NASA Thesaurus*.

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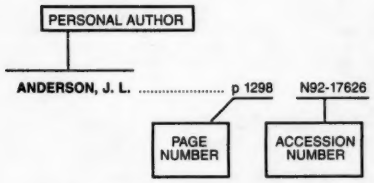

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ISHIDA, S. p 1755 N92-20743
ISSAHARY, DAVID p 1830 N92-20820
IURIICHUK, I. N. p 1893 N92-20425
IVANOV, V. I. p 1784 N92-20139

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JACKSON, G. L. p 1800 N92-20348
JACOBS, I. p 1849 N92-20440
JACOBS, J. M. J. W. p 1741 N92-20498
JAMIESON, TERRANCE J. p 1883 N92-20877
JANKOWSKI, A. F. p 1896 N92-21062
JANSSEN, R. A. J. p 1775 N92-20802
p 1775 N92-20803
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p 1776 N92-20807
JARRATT, K. B. p 1797 N92-20897
JARRIGE, J. L. p 1860 N92-20597
JASPER, G. L. p 1845 N92-20411
JAYNE, J. T. p 1772 N92-20331
JENKINS, BILLY p 1788 N92-20681
JENSEN, K. F. p 1839 N92-20466
JIACHI, JIANG p 1758 N92-20768
JOHN, MICHAEL p 1905 N92-20509
JOHNSON, B. V. p 1806 N92-20235
JOHNSON, CATHERINE C. p 1852 N92-20353
JOHNSON, D. J. p 1776 N92-20991
JOHNSON, DALE W. p 1836 N92-20200
JOHNSON, DAVID E. p 1811 N92-20837
JOHNSON, DAVID L. p 1741 N92-20674
JOHNSON, J. O. p 1885 N92-20998
JOHNSON, NOAH R. p 1881 N92-20309
JOHNSTONE, ERIC p 1795 N92-20534
JONES, DENNIS F. p 1785 N92-20415
JONES, J. H. p 1801 N92-20492
JONES, K. S. p 1892 N92-20220
JONES, L. L. p 1778 N92-20095
JONES, M. p 1861 N92-20601
JONES, R. W. p 1771 N92-20093
JONES, SIMON F. p 1776 N92-20946
JONES, WAYNE C. p 1811 N92-20837
JONG, J. p 1801 N92-20492
JORDAN, R. F. p 1779 N92-20403
JORGE, J. A. p 1855 N92-21039
JOSHI, A. p 1774 N92-20658
JOSLIN, D. L. p 1892 N92-20307
JOYNER, W. M. p 1840 N92-20702

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KACHRU, R. p 1887 N92-20708
KACIUBA-USCILKO, H. p 1849 N92-20276
KAEDING, MATTHIAS p 1853 N92-20170
KALDEICH, BRIGITTE p 1750 N92-20715
KAMAL, AGBARIAH p 1874 N92-20835
KAMEI, KATSUMI p 1768 N92-20561
KAMIYAMA, TAKAYUKI p 1768 N92-20561
KAMUPINGENE, A. H. p 1874 N92-20799
KANDA, HIDESADA p 1811 N92-20919
KANE, MICHAEL D. p 1828 N92-20191
KANE, S. p 1837 N92-20260
KANG, JONGMIN p 1878 N92-20360
KANTERS, J. A. p 1775 N92-20803
KAO, SHIUNG-PO p 1772 N92-20337
KAO, Y. H. p 1896 N92-21060
KAPLAN, D. B. p 1880 N92-20134
KARDASHEV, B. K. p 1784 N92-20139
KAREN, B. p 1783 N92-20122
KARILA, ARTO T. p 1854 N92-20935
KARLEMO, T. p 1825 N92-20452
KASSOY, D. R. p 1810 N92-20684
KASZA, G. L. p 1830 N92-21004
KATNIK, GREGORY N. p 1763 N92-20955
KATZ, MATTHEW J. p 1792 N92-20865
KAUFELER, PIERRE p 1757 N92-20758
KAUFFMAN, R. L. p 1818 N92-20558
KAUFMAN, JAMES MORRIS p 1912 N92-20912
KAWAGUCHI, JUNICHIRO p 1766 N92-20922
KEICHER, D. M. p 1779 N92-20218
KEITER, JERRY p 1743 N92-20064
KELLMAN, A. p 1888 N92-20083
KELLMAN, A. G. p 1800 N92-20348
KELLY, J. p 1774 N92-20641
KENDIG, M. W. p 1779 N92-20438
KENNEDY, W. L. p 1884 N92-20082
KENWORTHEY, W. H., JR. p 1902 N92-21035
KERBEL, G. D. p 1888 N92-20115
KERKHOFF, HANS-GEORG p 1880 N92-20174
KEUNE, C. M. p 1854 N92-20900
KHALID, MOHAMED A. p 1829 N92-20358
KHOUNSARY, A. p 1895 N92-20932
KHOUNSARY, A. M. p 1895 N92-20977
KIEHLING, REINHARD p 1758 N92-20766
KIM, HAK JUNG p 1907 N92-20335
KIM, HWA-SOO p 1857 N92-20362
KIM, KIHONG p 1806 N92-20238
KING, A. W. p 1834 N92-20100
KING, EVERETT E. p 1802 N92-20874
KING, MERRILL K. p 1788 N92-20884
KINOSHITA, H. p 1777 N92-20092
KIRIS, CETIN p 1849 N92-20668
KLAVETTER, E. A. p 1787 N92-20132
p 1788 N92-20858
KLEBESADEL, R. W. p 1914 N92-20416
KLEPPNER, DANIEL p 1804 N92-20983
KLINE, M. C. p 1771 N92-20075
KLOFMAN, ITZHAK p 1909 N92-20903
KLUEH, R. L. p 1778 N92-20096
KNAPP, J. A. p 1890 N92-20086
KNIPP, DARREN p 1743 N92-20064
KNOWLTON, T. M. p 1813 N92-21050
KOEHLER, GRANT p 1745 N92-20664
KOENIG, JOAN A. p 1790 N92-20252
KOESTER, D. A. p 1767 N92-20136
KOESTERS, BERND p 1862 N92-20607
KOKOLIOS, ALEX p 1745 N92-20875
KOLB, EDWARD W. p 1897 N92-20487
KOLB, G. J. p 1832 N92-20131
KOMOROWSKI, J. P. p 1787 N92-21018
KONEV, S. V. p 1812 N92-20923
KONSTANTAKIS, GEORGE C. p 1745 N92-20665
KORMICKI, J. p 1882 N92-20550
KORST, JAN p 1868 N92-20172
KOSSON, D. S. p 1835 N92-20110
p 1835 N92-20111
KOSTER, SCOTT J. p 1899 N92-20995
KOSTERLITZ, J. M. p 1871 N92-20104
KOT, C. A. p 1823 N92-20105
KOTTKE, THOMAS p 1854 N92-20964
KOZLOWSKI, M. p 1816 N92-20090
KRABBE, A. p 1904 N92-20463
KRAMER, P.-A. p 1763 N92-20249
KRANER, H. W. p 1784 N92-20298
KRASILSHIKOV, M. N. p 1761 N92-20789
KREMER, P. p 1794 N92-20469
KRINSKY, S. p 1818 N92-20557
KRISTIANSEN, M. p 1883 N92-20914
KRUMREY, M. p 1888 N92-21030
KUHL, A. L. p 1812 N92-21007
KUHN, D. R. p 1865 N92-20642
KUHNLE, VOLKMAR p 1905 N92-20508
KULANDER, K. C. p 1797 N92-20962
KUNZ, KARL S. p 1794 N92-20273
p 1794 N92-20442
p 1795 N92-20486
p 1795 N92-20672
p 1796 N92-20673
p 1796 N92-20680
KUO, K. K. p 1771 N92-20075
KURIHARA, M. p 1754 N92-20738
KURIYAMA, M. p 1892 N92-20251
KUSTOV, S. B. p 1784 N92-20139
KUZAY, T. M. p 1895 N92-20977
KWUN, H. p 1780 N92-20569
KY, NGUYEN ANH p 1874 N92-20799

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LACKNER, K. S. p 1890 N92-20091
LACOSS, RICHARD T. p 1870 N92-20863
LAFARGE, R. A. p 1788 N92-20344
LAFEMINA, J. P. p 1891 N92-20217
LAGASSE, R. R. p 1800 N92-20142
LAGUNA, P. p 1908 N92-20423
LAHEY, R. T., JR. p 1812 N92-20979
LAHR, THOMAS F. p 1899 N92-20150
p 1901 N92-20516
LAIDET, L. p 1761 N92-20784
LAITILA, J. p 1813 N92-20227
LAL, R. p 1892 N92-20251
LALLMAN, FREDERICK J. p 1747 N92-20195
LAMARSH, WILLIAM J., II p 1744 N92-20417
LAMERS, J. p 1830 N92-20426
LAMONTAGNE, RENE p 1793 N92-20159
LANAGAN, M. T. p 1783 N92-20101
LANDMANN, A. E. p 1748 N92-20376
LANGELAND-KNUDSEN, J. p 1862 N92-20612
LANGLOIS, G. p 1863 N92-20616
LANNING, D. D. p 1886 N92-21038
LAOR, ROY p 1866 N92-20832
LARCHEVEQUE, MICHELE p 1805 N92-20230
LASSILA, D. H. p 1782 N92-21029
LATAITIS, R. J. p 1847 N92-20257
LAURRAURI, D. p 1771 N92-20231
LAUTIER, ELISABETH p 1864 N92-20621
LAWRENCE, R. J. p 1818 N92-20854
LAYNE, STEVEN JAMES p 1744 N92-20267
LAZARUS, E. p 1888 N92-20083
LE, GUAN p 1907 N92-20327
LEADBETTER, M. R. p 1876 N92-21014
LEAODEMORAESNOVO, EVLYN MARCIA p 1830 N92-20882
LEBLANC, M. M. p 1782 N92-21029
LEBRET, YANN p 1806 N92-20232
LEDBETTER, H. p 1800 N92-20447
LEE, DAVID CHUNG LIANG p 1830 N92-20956
LEE, E. H. p 1778 N92-20125
p 1786 N92-20957
LEE, J. p 1834 N92-20099
LEE, JOOYOUNG p 1871 N92-20104
LEE, KANG Y. p 1798 N92-21017
LEE, MYONGSOO p 1786 N92-20791
LEE, P. p 1914 N92-20416
LEE, R. N. p 1837 N92-20351
LEE, R. W. p 1889 N92-20976
LEE, T-H. p 1793 N92-20197

LEE, W. K. p 1895 N92-20932
LEFTWICH, P. W. p 1844 N92-20264
LEGALL, J. CLAUDE p 1754 N92-20736
LEGENNE, JEROME p 1759 N92-20777
LEHRMAN, I. p 1818 N92-20557
LEI, M. p 1800 N92-20447
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LEITCH, R. R. p 1878 N92-20381
LEMAY, J. D. p 1787 N92-21066
LENSINK, J. G. p 1893 N92-20350
LENSTRA, JAN KAREL p 1868 N92-20172
LENTZ, TERIANN p 1847 N92-20712
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LERCH, BRADLEY A. p 1770 N92-20841
LESIEUTRE, DANIEL J. p 1741 N92-20674
LESTER, D. C. p 1898 N92-20910
LESTRIEZ, J. C. p 1860 N92-20596
LESUEUR, PATRICK p 1864 N92-20621
LEVICH, E. p 1813 N92-21048
LEVIN, B. C. p 1792 N92-20814
LEWIS, G. M. p 1746 N92-20460
LHERMITTE, R. p 1830 N92-20868
LHUILLIER, A. p 1797 N92-20962
LI, L. p 1782 N92-20080
LI, ZHENG p 1784 N92-20298
LIANG, FANG-PEI p 1740 N92-20332
LIBES, DON p 1813 N92-20208
LICATA, J. P. p 1911 N92-20518
p 1911 N92-20538
LICHOTA, RANDALL W. p 1876 N92-20966
LIEDL, G. L. p 1896 N92-21031
LIM, CHIENG-FAI p 1855 N92-20061
LIM, E. C. p 1881 N92-20258
LIN, D. L. p 1782 N92-20080
LIN, F. C. p 1902 N92-21013
LIN, S. H. p 1782 N92-20089
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LIN, SIN-SHONG p 1769 N92-20824
LIND, GREGORY S. p 1745 N92-20665
LINDBERG, ROBERT p 1752 N92-20729
LINDBERG, STEVEN E. p 1836 N92-20200
LINDE, MAGNUS p 1739 N92-20229
LING, ZHI-GUANG p 1812 N92-20924
LINK, H. F. p 1911 N92-20050
LITSYN, S. N. p 1873 N92-20637
LIU, G. K. p 1884 N92-21054
LIU, HSIAOYING SHARON p 1900 N92-20284
LIU, J. Z. p 1802 N92-20861
LIU, K. p 1880 N92-20102
LIU, M. p 1774 N92-20658
LOBACHEV, V. I. p 1761 N92-20789
LOBSTEIN, ANTOINE C. p 1873 N92-20632
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LOFFMAN, R. S. p 1840 N92-20543
LOFTUS, JOSEPH P., JR. p 1760 N92-20781
p 1761 N92-20785
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LOLL, R. p 1897 N92-20382
LONGSTAFF, T. A. p 1867 N92-20959
LOOMIS, B. A. p 1777 N92-20092
p 1782 N92-20992
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p 1830 N92-20426
LORIER, PHILIPPE p 1859 N92-20590
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LOW, SCOTT p 1744 N92-20512
LOWNDES, D. H. p 1891 N92-20124
p 1894 N92-20567
LOY, D. A. p 1783 N92-20113
LU, FRANCOIS p 1753 N92-20733
LU, GANG p 1914 N92-20859
LUCK, R. p 1886 N92-20394
LUDLOW, J. p 1774 N92-20658
LUEBBERS, RAYMOND J. p 1794 N92-20273
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LUETHI, T. p 1787 N92-21045
LUMPKIN, A. H. p 1816 N92-20290
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LUTON, JEAN-MARIE p 1751 N92-20716
LUTTMANN, HELMUT p 1759 N92-20772
LUTZ, A. E. p 1772 N92-20329
LUTZ, E. p 1840 N92-20540
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LYELL, M. J. p 1809 N92-20409
LYON, KEITH p 1752 N92-20729
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MACDONALD, ROBERT B. p 1858 N92-20564
MACE, G. p 1756 N92-20756
MACGREGOR, G. R. p 1748 N92-20376
MACRANDER, A. T. p 1895 N92-20932
MADON, PIERRE J. p 1751 N92-20718
MAEDA, Y. p 1754 N92-20738
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MANN, D. L. p 1747 N92-20573
MANSUR, L. K. p 1778 N92-20125
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MANTIPLY, E. p 1793 N92-20223
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MARCONI, MAX L. p 1910 N92-20535
MARCUS, LENNART p 1751 N92-20720
MARKOVITZ, P. p 1900 N92-20489
MARSHALL, DAVID L. p 1745 N92-20665
MARSHALL, KAY p 1836 N92-20225
MARSHALL, W. p 1820 N92-20339
MARSOLF, B. A. p 1865 N92-20675
MARTEL, FRANCK p 1759 N92-20772
MARTELLI, A. p 1864 N92-20619
MARTIN-DUPONT, FRANCOIS p 1865 N92-20629
MARTIN, J. E. p 1786 N92-20860
MARTIN, S. J. p 1788 N92-20858
MARTINS, E. p 1893 N92-20432
MARUSAK, RONALD EUGENE p 1823 N92-20149
MAS-HESSE, J. MIGUEL p 1914 N92-20464
MASON, S. p 1884 N92-20943
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MATOGAWA, Y. p 1754 N92-20738
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MAU, T. K. p 1888 N92-20115
MAURIZE, JEAN-CLAUDE p 1757 N92-20763
MAYBERRY, M. J. p 1886 N92-21041
MAYHALL, D. J. p 1799 N92-20048
MAZZA, C. p 1861 N92-20604
MCARDLE, JACK G. p 1741 N92-20934
MCCAMY, J. W. p 1894 N92-20567
MCCLELLAND, J. F. p 1771 N92-20093
MCCONNELL, B. W. p 1798 N92-21047
MCCOUBREY, A. O. p 1792 N92-20646
MCCOY, M. G. p 1888 N92-20115
MCCULLOUGH, CLAIRE L. p 1869 N92-20275
MCCUNE, W. W. p 1869 N92-21001
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MCDEVITT, T. KEVIN p 1739 N92-20283
MCDONALD, J. p 1884 N92-20990
MCDONALD, S. C. p 1835 N92-20114
MCDONALD, V. J. p 1838 N92-20444
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p 1839 N92-20446
MCFADDEN, G. B. p 1806 N92-20289
MCHARGUE, C. J. p 1892 N92-20307
MCKEE, E. p 1888 N92-20083
MCKEE, SHAWN PATRICK p 1913 N92-20311
MCKEE, SUZANNE p 1851 N92-20895
MCKEE, V. B. p 1814 N92-20248
MCKENZIE, S. G. p 1781 N92-20911
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MCLAUGHLIN, J. C. p 1787 N92-21063
MCLEAN, J. S. p 1838 N92-20444
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MCLINDEN, M. O. p 1790 N92-20107
MCNEIL, F. J. p 1903 N92-20700
MCNIFF, E. J., JR. p 1891 N92-20216
MCPHADEN, M. J. p 1848 N92-20262
MCWHORTER, ALAN L. p 1895 N92-20672
MEAD, GEORGE W. p 1752 N92-20723
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MEHU, BRUNO p 1859 N92-20590
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MEIRI, DAVID p 1876 N92-20907
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MEUNIER, P. p 1811 N92-20893
MEYER, DOMINIQUE p 1863 N92-20615
MICHAELIS, ELIAS K. p 1848 N92-20704
MICHAELIS, HORST p 1753 N92-20731
MICKELSON, ALAN R. p 1804 N92-21010
MICKENS, RONALD E. p 1874 N92-20886
MICKEY, F. p 1757 N92-20764
MICOL, JOHN R. p 1810 N92-20677
MIGNOT, MICHEL p 1752 N92-20726
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MILCHTAICH, IGAL p 1876 N92-20908
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MILTENBERG, J. W. p 1829 N92-20395
MINECK, RAYMOND E. p 1740 N92-20494
MINIS, I. p 1870 N92-20517
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MISRA, MOHAN S. p 1825 N92-20277
MITCHELL, A. W. p 1892 N92-20342
MITCHELL, J. P. p 1765 N92-20271
MITCHELL, MYRON J. p 1836 N92-20200
MITCHELL, R. L. p 1831 N92-20054
p 1890 N92-20055
MITCHELL, W. J. p 1837 N92-20333
MIYOSHI, KAZUHISA p 1785 N92-20660
MODICA, L. G. p 1841 N92-20826
MONK, PETER p 1796 N92-20687
MONNA, W. A. A. p 1847 N92-20846
MONTENBRUCK, O. p 1758 N92-20765
MOONEY, G. D. p 1831 N92-20054
MOORE, GARY T. p 1851 N92-20268
MOORE, JOEL DAVID p 1744 N92-20267
MOORE, LORNA G. p 1850 N92-20709
MOORHOUSE, ALAN p 1908 N92-20375
MORANI, ANTONELLO p 1758 N92-20769
MORE, K. L. p 1767 N92-20136
MORGAN, J. S. p 1814 N92-20282
MORGAN, K. p 1804 N92-21057
MORI, HIDEHIKO p 1755 N92-20743
MORRELL, JIMMY R. p 1752 N92-20724
MORRIS, K. A. p 1870 N92-20662
MORRIS, S. C. p 1834 N92-20099
MORRIS, T. O. p 1784 N92-20137
MORTAL, GILLES p 1759 N92-20772
MOSES, JULIANNE IVES p 1910 N92-20926
MOSIER, MARTY p 1752 N92-20729
MOUDDEN, A. H. p 1895 N92-20867
MOURAD, ANTOINE N. p 1857 N92-20374
MOURY, MONIQUE p 1758 N92-20767
MUDKAVI, VIDYADHAR YOGESHWAR p 1806 N92-20300
MUELLER, P. p 1888 N92-21030
MUENCH, ROLF E. p 1757 N92-20760
MULLET, B. p 1860 N92-20600
MUNASINGHE, M. p 1840 N92-20540
MUNDING, G. p 1763 N92-20249
MUNDY, A. M. p 1779 N92-20438
MURAKAMI, MASAHIDE p 1811 N92-20920
MURRAY, B. T. p 1806 N92-20289
MUSSELMAN, BRIAN J. p 1876 N92-20996
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MYHRE, L. G. p 1850 N92-21021
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NAGLE, GEORGE V. p 1811 N92-20837
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NAKAO, KENJI p 1768 N92-20561
NAKATANI, ICHIRO p 1766 N92-20922
NALLO, W. p 1757 N92-20764
NAMAVAR, F. p 1891 N92-20199
NAMAZIAN, M. p 1774 N92-20641
NARDELLA, A. p 1757 N92-20759
NASU, K. p 1782 N92-20080
NATHAN, ARNOLD p 1744 N92-20500
NATIONS, J. A. p 1902 N92-21033
NAZAR, K. p 1849 N92-20276
NELSON, C. p 1804 N92-20988
NELSON, J. J. p 1911 N92-20538
NEMHAUSER, GEORGE L. p 1867 N92-20942
NEUMAIER, STEFAN p 1911 N92-20502
NEVILL, GALE E., JR. p 1852 N92-20583
NEWBY, M. J. p 1822 N92-20168
p 1875 N92-20233
NEWKIRK, MICHAEL AVERY p 1817 N92-20323
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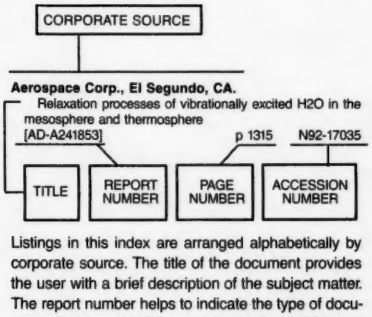

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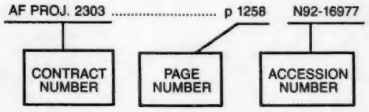

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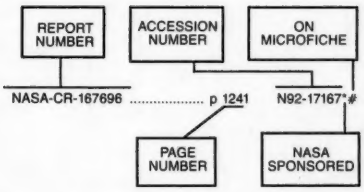

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CSA-DSM-CR-91-007 ..... p 1827 N92-20842 #

CTN-91-60291 ..... p 1787 N92-21018 #
CTN-92-60397 ..... p 1856 N92-20272 #
CTN-92-60399 ..... p 1856 N92-20186 #
CTN-92-60400 ..... p 1857 N92-20413 #
CTN-92-60401 ..... p 1857 N92-20414 #
CTN-92-60402 ..... p 1855 N92-20073 #
CTN-92-60403 ..... p 1856 N92-20187 #
CTN-92-60404 ..... p 1853 N92-20188 #
CTN-92-60407 ..... p 1822 N92-20074 #
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CTN-92-60422 ..... p 1883 N92-20877 #
CTN-92-60423 ..... p 1883 N92-20845 #
CTN-92-60424 ..... p 1793 N92-20189 #
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CTN-92-60444 ..... p 1803 N92-20947 #
CTN-92-60446 ..... p 1795 N92-20534 #
CTN-92-60449 ..... p 1853 N92-20879 #
CTN-92-60450 ..... p 1849 N92-20440 #

CWI-CS-R9120 ..... p 1858 N92-20501 #

DCIEM-91-44 ..... p 1849 N92-20440 #

DCN-91-203-099-37-06 ..... p 1838 N92-20444 #
DCN-91-203-099-37-07 ..... p 1839 N92-20445 #
DCN-91-203-099-37-08 ..... p 1839 N92-20446 #

DEI-D-425 ..... p 1823 N92-20072 * #

DE91-018178 ..... p 1885 N92-20998 #
DE91-018396 ..... p 1851 N92-20046 #
DE91-018401 ..... p 1831 N92-20047 #
DE92-000149 ..... p 1902 N92-21033 #
DE92-000243 ..... p 1776 N92-20999 #
DE92-001018 ..... p 1812 N92-21000 #
DE92-001176 ..... p 1833 N92-20648 #
DE92-001180 ..... p 1790 N92-20049 #
DE92-001181 ..... p 1911 N92-20050 #

DE92-001184 ..... p 1831 N92-20051 #
DE92-001185 ..... p 1805 N92-20052 #
DE92-001186 ..... p 1831 N92-20053 #
DE92-001189 ..... p 1834 N92-21034 #
DE92-001194 ..... p 1831 N92-20054 #
DE92-001195 ..... p 1890 N92-20055 #
DE92-001197 ..... p 1894 N92-20701 #
DE92-001200 ..... p 1833 N92-20245 #
DE92-001621 ..... p 1832 N92-20057 #
DE92-001676 ..... p 1902 N92-21035 #
DE92-001807 ..... p 1886 N92-21036 #
DE92-001945 ..... p 1766 N92-21037 #
DE92-002147 ..... p 1837 N92-20351 #
DE92-002301 ..... p 1886 N92-21038 #
DE92-002315 ..... p 1813 N92-20141 #
DE92-002595 ..... p 1855 N92-21039 #
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DE92-002931 ..... p 1834 N92-21040 #
DE92-002949 ..... p 1886 N92-21041 #
DE92-002987 ..... p 1804 N92-21042 #
DE92-003009 ..... p 1766 N92-21043 #
DE92-003042 ..... p 1813 N92-21048 #
DE92-003064 ..... p 1831 N92-21049 #
DE92-003081 ..... p 1813 N92-21050 #
DE92-003232 ..... p 1869 N92-21001 #
DE92-003295 ..... p 1764 N92-21051 #
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DE92-003396 ..... p 1849 N92-21044 #
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DE92-003553 ..... p 1787 N92-21063 #
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DE92-003642 ..... p 1777 N92-21058 #
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DE92-003693 ..... p 1777 N92-21061 #
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DE92-003955 ..... p 1883 N92-20914 #
DE92-003989 ..... p 1877 N92-21070 #
DE92-004096 ..... p 1781 N92-20852 #
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DE92-005014 ..... p 1816 N92-20291 #
DE92-005015 ..... p 1816 N92-20293 #
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DE92-005063 ..... p 1907 N92-20343 #
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DE92-005119 ..... p 1882 N92-20550 #
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DE92-005128 ..... p 1882 N92-20552 #
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DE92-005161 ..... p 1881 N92-20219 #
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DE92-005181 ..... p 1788 N92-20344 #
DE92-005186 ..... p 1819 N92-20143 #
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DE92-005219 ..... p 1892 N92-20342 #
DE92-005221 ..... p 1884 N92-20082 #
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DE92-005233 ..... p 1880 N92-20067 #
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DE92-005246 ..... p 1799 N92-20048 #
DE92-005268 ..... p 1805 N92-20121 #
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DE92-005363 ..... p 1892 N92-20259 #
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DE92-005377 ..... p 1773 N92-20577 #
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DE92-005395 ..... p 1889 N92-20302 #
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DE92-006457 ..... p 1882 N92-20349 #
DE92-006478 ..... p 1850 N92-20987 #
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DE92-006486 ..... p 1852 N92-21002 #
DE92-006495 ..... p 1843 N92-21003 #
DE92-006498 ..... p 1830 N92-21004 #
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DE92-006708 ..... p 1880 N92-20060 #
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DE92-006853 ..... p 1778 N92-20145 #
DE92-006860 ..... p 1786 N92-20957 #
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DE92-006874 ..... p 1843 N92-20970 #
DE92-006883 ..... p 1818 N92-20558 #
DE92-006897 ..... p 1773 N92-20559 #
DE92-006981 ..... p 1783 N92-20101 #
DE92-006985 ..... p 1893 N92-20560 #
DE92-006990 ..... p 1880 N92-20102 #
DE92-006993 ..... p 1871 N92-20103 #
DE92-006994 ..... p 1802 N92-20861 #
DE92-006995 ..... p 1871 N92-20104 #
DE92-006998 ..... p 1823 N92-20105 #
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DE92-007119 ..... p 1782 N92-20089 #
DE92-007123 ..... p 1880 N92-20135 #
DE92-007176 ..... p 1779 N92-20438 #
DE92-007185 ..... p 1800 N92-20407 #
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DE92-007201 ..... p 1804 N92-20971 #
DE92-007202 ..... p 1885 N92-20972 #
DE92-007216 ..... p 1825 N92-20352 #
DE92-007257 ..... p 1892 N92-20220 #
DE92-007268 ..... p 1749 N92-21028 #
DE92-007275 ..... p 1816 N92-20090 #
DE92-007297 ..... p 1788 N92-20958 #
DE92-007298 ..... p 1789 N92-20989 #
DE92-007306 ..... p 1782 N92-21029 #
DE92-007307 ..... p 1884 N92-20990 #
DE92-007325 ..... p 1906 N92-20973 #
DE92-007326 ..... p 1867 N92-20959 #
DE92-007327 ..... p 1854 N92-20960 #
DE92-007329 ..... p 1854 N92-20961 #
DE92-007332 ..... p 1885 N92-20974 #
DE92-007337 ..... p 1812 N92-21007 #
DE92-007340 ..... p 1888 N92-21030 #
DE92-007346 ..... p 1854 N92-20975 #
DE92-007347 ..... p 1889 N92-20976 #
DE92-007351 ..... p 1797 N92-20962 #
DE92-007354 ..... p 1885 N92-20345 #
DE92-007366 ..... p 1895 N92-20977 #
DE92-007367 ..... p 1776 N92-20991 #
DE92-007368 ..... p 1782 N92-20992 #
DE92-007410 ..... p 1896 N92-21031 #
DE92-007411 ..... p 1911 N92-21006 #
DE92-007516 ..... p 1867 N92-21032 #
DE92-600632 ..... p 1881 N92-20206 #
DE92-603625 ..... p 1874 N92-20799 #
DE92-606585 ..... p 1784 N92-20139 #
DE92-607360 ..... p 1886 N92-20128 #
DE92-608364 ..... p 1897 N92-20431 #
DE92-608547 ..... p 1893 N92-20432 #
DE92-608686 ..... p 1817 N92-20433 #
DE92-608987 ..... p 1893 N92-20434 #
DE92-614466 ..... p 1889 N92-21025 #
DE92-614558 ..... p 1896 N92-21026 #
DE92-614571 ..... p 1896 N92-21027 #
DE92-731701 ..... p 1768 N92-20561 #

DLR-FB-90-19 ..... p 1791 N92-20639 #
DLR-FB-91-20 ..... p 1780 N92-20562 #
DLR-FB-91-23 ..... p 1743 N92-20902 #

DNA-TR-91-111 ..... p 1848 N92-20813 #

DOE-90-09 ..... p 1793 N92-20189 #

DOE/BC-14600/17 ..... p 1812 N92-21000 #

DOE/CE-15412/T3 ..... p 1780 N92-20556 #

DOE/ER-03065/T10 ..... p 1885 N92-20345 #
DOE/ER-12103/2 ..... p 1815 N92-21005 #
DOE/ER-13323/6 ..... p 1777 N92-21068 #
DOE/ER-13411/2 ..... p 1771 N92-20127 #
DOE/ER-13482/6 ..... p 1894 N92-20579 #
DOE/ER-13584/T1 ..... p 1777 N92-21061 #
DOE/ER-13629/5 ..... p 1782 N92-20087 #
DOE/ER-13654/5 ..... p 1774 N92-20580 #
DOE/ER-13673/T2 ..... p 1805 N92-20121 #
DOE/ER-13720/4 ..... p 1880 N92-20060 #
DOE/ER-13742/5 ..... p 1849 N92-21044 #
DOE/ER-13807/T3 ..... p 1844 N92-21052 #
DOE/ER-13825/7 ..... p 1896 N92-20126 #
DOE/ER-13837/1 ..... p 1813 N92-21048 #
DOE/ER-13935/3 ..... p 1779 N92-20403 #
DOE/ER-14024/3 ..... p 1881 N92-20258 #
DOE/ER-14180/1 ..... p 1780 N92-20569 #
DOE/ER-25017/5 ..... p 1858 N92-20566 #
DOE/ER-40410/3 ..... p 1882 N92-20530 #
DOE/ER-40420/T1 ..... p 1884 N92-21053 #
DOE/ER-45259/12 ..... p 1893 N92-20553 #
DOE/ER-45283/10 ..... p 1896 N92-21060 #
DOE/ER-45305/3 ..... p 1782 N92-20089 #
DOE/ER-45305/5 ..... p 1783 N92-20118 #
DOE/ER-45314/4 ..... p 1894 N92-20570 #
DOE/ER-45427/2 ..... p 1896 N92-21031 #
DOE/ER-53262/T2 ..... p 1890 N92-21046 #

DOE/ID-12735/T20 ..... p 1889 N92-20406 #

DOE/NASA/5776-1 ..... p 1785 N92-20644 * #

DOE/PC-88928/T7 ..... p 1889 N92-20346 #
DOE/PC-88951/9 ..... p 1813 N92-21050 #

DOE/PE-0100P ..... p 1789 N92-21056 #

DOE/SF-16498/T1 ..... p 1816 N92-20116 #
DOE/SF-18852/T7 ..... p 1766 N92-21037 #

DOT/FAA/CT-TN91/57 ..... p 1795 N92-20653 #

DREA-CR-90-452 ..... p 1824 N92-20190 #
DREA-CR-90-454 ..... p 1867 N92-20945 #
DREA-CR-91-404 ..... p 1803 N92-20947 #

DREA-1074 ..... p 1793 N92-20160 #
DREA-90-101 ..... p 1785 N92-20415 #

DREO-TN-91-17 ..... p 1811 N92-20893 #
DREO-TN-91-8 ..... p 1815 N92-20968 #

DREO-91-2 ..... p 1793 N92-20157 #
DREO-91-3 ..... p 1793 N92-20159 #
DREO-91-611 ..... p 1793 N92 20189 #

DREO/PSD/EPS-01/91 ..... p 1786 N92-20953 #

DREP-91-09 ..... p 1793 N92-20158 #

D6-55817 ..... p 1748 N92-20376 * #
D615-11901 ..... p 1910 N92-20901 * #

E-5369 ..... p 1741 N92-20934 * #
E-6048 ..... p 1821 N92-20815 * #
E-6150 ..... p 1746 N92-20196 * #
E-6578 ..... p 1765 N92-20522 * #
E-6620 ..... p 1747 N92-20525 * #
E-6664 ..... p 1766 N92-20585 * #
E-6685 ..... p 1785 N92-20644 * #
E-6714 ..... p 1824 N92-20212 * #
E-6729 ..... p 1785 N92-20660 * #
E-6745 ..... p 1765 N92-20065 * #
E-6775 ..... p 1746 N92-20523 * #
E-6819 ..... p 1784 N92-20380 * #
E-6852 ..... p 1893 N92-20519 * #
E-6870 ..... p 1765 N92-20355 * #
E-6880 ..... p 1747 N92-20650 * #
E-6888 ..... p 1770 N92-20841 * #
E-6905 ..... p 1748 N92-20586 * #
E-6908 ..... p 1806 N92-20235 * #
E-6911 ..... p 1833 N92-20671 * #
E-6922 ..... p 1833 N92-20493 * #
E-6955 ..... p 1810 N92-20520 * #

ECAO-R-0314 ..... p 1838 N92-20439 #

EGG-M-90501 ..... p 1764 N92-21051 #

EPA/AA/CTAB-91/05 ..... p 1800 N92-20287 #
EPA/AA/CTAB-91/06 ..... p 1819 N92-20254 #

EPA/430/09-91/020 ..... p 1839 N92-20481 #
EPA/450/3-91/015 ..... p 1839 N92-20445 #
EPA/450/3-91/016 ..... p 1838 N92-20444 #
EPA/450/3-91/017 ..... p 1839 N92-20446 #
EPA/450/4-91/010 ..... p 1836 N92-20255 #
EPA/520/6-91/020 ..... p 1793 N92-20223 #
EPA/600/D-91/240 ..... p 1838 N92-20441 #
EPA/600/D-91/248 ..... p 1837 N92-20398 #
EPA/600/D-91/252 ..... p 1835 N92-20109 #
EPA/600/D-91/253 ..... p 1835 N92-20110 #
EPA/600/D-91/254 ..... p 1835 N92-20111 #
EPA/600/D-91/255 ..... p 1837 N92-20333 #
EPA/600/D-91/257 ..... p 1832 N92-20112 #
EPA/600/D-91/260 ..... p 1833 N92-20334 #
EPA/600/D-91/274 ..... p 1837 N92-20340 #
EPA/600/M-91/040 ..... p 1841 N92-20817 #
EPA/600/3-91/039 ..... p 1836 N92-20207 #
EPA/600/3-91/070 ..... p 1838 N92-20424 #
EPA/600/7-91/006 ..... p 1841 N92-20826 #
EPA/600/8-90/044 ..... p 1838 N92-20439 #
EPA/600/8-91/215 ..... p 1836 N92-20256 #
EPA/600/9-91/042 ..... p 1836 N92-20225 #
EPA/625/3-91/020 ..... p 1839 N92-20483 #
EPA/625/6-91/026 ..... p 1839 N92-20478 #
EPA/625/7-91/015 ..... p 1835 N92-20108 #

ERIM-196100-25-F ..... p 1796 N92-20699 #
ERIM-207500-7-T ..... p 1797 N92-20871 #
ERIM-213235-2-F ..... p 1819 N92-20870 #
ERIM-227000-1-F ..... p 1815 N92-20997 #

ES/ER/TM-24 ..... p 1838 N92-20402 #

ESA-SP-342 ..... p 1750 N92-20715 #

ESA-TT-1239 ..... p 1791 N92-20639 #

ESD-TR-91-106 ..... p 1895 N92-20872 #
ESD-TR-91-110 ..... p 1797 N92-20847 #

ESD-TR-91-112 ..... p 1797 N92-20965 #
ESD-TR-91-170 ..... p 1870 N92-20863 #

ESD-91-TR-20 ..... p 1876 N92-20966 #

ETN-92-90559 ..... p 1858 N92-20501 #
ETN-92-90632 ..... p 1911 N92-20502 #
ETN-92-90633 ..... p 1914 N92-20503 #
ETN-92-90634 ..... p 1763 N92-20504 #
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ETN-92-90636 ..... p 1801 N92-20506 #
ETN-92-90637 ..... p 1909 N92-20507 #
ETN-92-90638 ..... p 1905 N92-20508 #
ETN-92-90639 ..... p 1905 N92-20509 #
ETN-92-90640 ..... p 1910 N92-20649 #
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ETN-92-90653 ..... p 1878 N92-20381 #
ETN-92-90654 ..... p 1866 N92-20792 #
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NAS 1.26:189902 ..... p 1808 N92-20372 * #

NAS 1.26:189907 ..... p 1790 N92-20373 * #
NAS 1.26:189914 ..... p 1857 N92-20374 * #
NAS 1.26:189925 ..... p 1855 N92-20061 * #
NAS 1.26:189932 ..... p 1793 N92-20197 * #
NAS 1.26:189937 ..... p 1858 N92-20564 * #
NAS 1.26:189938 ..... p 1795 N92-20548 * #
NAS 1.26:189942 ..... p 1858 N92-20549 * #
NAS 1.26:189944 ..... p 1795 N92-20563 * #
NAS 1.26:189947 ..... p 1871 N92-20062 * #
NAS 1.26:189969 ..... p 1857 N92-20362 *
NAS 1.26:189970 ..... p 1749 N92-20528 * #
NAS 1.26:189974 ..... p 1745 N92-20664 * #
NAS 1.26:189975 ..... p 1820 N92-20401 * #
NAS 1.26:189980 ..... p 1744 N92-20512 * #
NAS 1.26:189985 ..... p 1852 N92-20430 * #
NAS 1.26:189988 ..... p 1744 N92-20267 * #
NAS 1.26:190006 ..... p 1762 N92-20666 * #
NAS 1.26:190007 ..... p 1745 N92-20665 * #
NAS 1.26:190017 ..... p 1852 N92-20583 * #
NAS 1.26:190018 ..... p 1762 N92-20667 * #
NAS 1.26:190024 ..... p 1743 N92-20064 * #
NAS 1.26:190025 ..... p 1745 N92-20875 * #
NAS 1.26:190026 ..... p 1745 N92-20951 * #
NAS 1.26:190027 ..... p 1851 N92-20268 * #
NAS 1.26:190047 ..... p 1892 N92-20251 * #
NAS 1.26:190062 ..... p 1841 N92-20270 * #
NAS 1.26:190063 ..... p 1852 N92-20269 * #
NAS 1.26:190072 ..... p 1903 N92-20069 * #
NAS 1.26:190076 ..... p 1849 N92-20668 * #
NAS 1.26:190079 ..... p 1877 N92-20515 * #
NAS 1.26:190081 ..... p 1818 N92-20659 * #
NAS 1.26:190085 ..... p 1906 N92-20071 * #
NAS 1.26:190086 ..... p 1809 N92-20409 * #
NAS 1.26:190095 ..... p 1828 N92-20798 * #
NAS 1.26:190099 ..... p 1795 N92-20672 * #
NAS 1.26:190100 ..... p 1794 N92-20442 * #
NAS 1.26:190102 ..... p 1796 N92-20680 * #
NAS 1.26:190103 ..... p 1796 N92-20673 * #
NAS 1.26:190104 ..... p 1795 N92-20486 * #
NAS 1.26:190110 ..... p 1794 N92-20273 * #
NAS 1.26:190111 ..... p 1857 N92-20419 * #
NAS 1.26:190112 ..... p 1848 N92-20422 * #
NAS 1.26:190113 ..... p 1771 N92-20075 * #
NAS 1.26:190116 ..... p 1907 N92-20354 * #
NAS 1.26:190121 ..... p 1897 N92-20487 * #
NAS 1.26:190122 ..... p 1909 N92-20490 * #
NAS 1.26:190128 ..... p 1814 N92-20282 * #
NAS 1.26:190130 ..... p 1744 N92-20280 * #
NAS 1.26:190131 ..... p 1870 N92-20517 * #
NAS 1.26:190137 ..... p 1762 N92-20537 * #
NAS 1.26:190140 ..... p 1764 N92-20822 * #
NAS 1.26:190142 ..... p 1910 N92-20535 * #
NAS 1.26:190149 ..... p 1805 N92-20120 * #
NAS 1.26:190151 ..... p 1750 N92-20917 * #
NAS 1.26:190156 ..... p 1912 N92-20916 * #
NAS 1.26:190163 ..... p 1773 N92-20524 * #
NAS 1.26:190165 ..... p 1840 N92-20526 * #
NAS 1.26:4424 ..... p 1824 N92-20194 * #
NAS 1.26:4430 ..... p 1746 N92-20196 * #
NAS 1.26:4432 ..... p 1741 N92-20674 * #
NAS 1.60:3132 ..... p 1740 N92-20494 * #
NAS 1.60:3136 ..... p 1747 N92-20195 * #
NAS 1.60:3157 ..... p 1810 N92-20677 * #
NAS 1.60:3165 ..... p 1879 N92-20479 * #
NAS 1.60:3169 ..... p 1741 N92-20545 * #
NAS 1.60:3173 ..... p 1769 N92-20679 * #
NAS 1.60:3177 ..... p 1766 N92-20949 * #
NAS 1.60:3179 ..... p 1771 N92-20950 * #
NAS 1.60:3183 ..... p 1746 N92-20546 * #
NAS 1.60:3215 ..... p 1801 N92-20492 * #
NAS 1.61:1273 ..... p 1777 N92-20063 * #
NAS 1.61:1274 ..... p 1794 N92-20404 * #

NASA-CR-184280 ..... p 1789 N92-20198 * #
NASA-CR-184284 ..... p 1846 N92-20670 * #
NASA-CR-184286 ..... p 1772 N92-20435 * #
NASA-CR-184287 ..... p 1765 N92-20243 * #
NASA-CR-184288 ..... p 1819 N92-20070 * #
NASA-CR-184289 ..... p 1819 N92-20244 * #
NASA-CR-184294 ..... p 1869 N92-20275 * #
NASA-CR-184296 ..... p 1788 N92-20681 * #
NASA-CR-184297 ..... p 1765 N92-20443 * #
NASA-CR-184298 ..... p 1912 N92-20661 * #
NASA-CR-186010 ..... p 1769 N92-20808 * #
NASA-CR-187229 ..... p 1768 N92-20484 * #
NASA-CR-187234 ..... p 1825 N92-20513 * #
NASA-CR-188618 ..... p 1789 N92-20214 * #
NASA-CR-188630 ..... p 1767 N92-20193 * #
NASA-CR-188749 ..... p 1761 N92-20844 * #
NASA-CR-188752 ..... p 1750 N92-20266 * #
NASA-CR-189016 ..... p 1910 N92-20901 * #
NASA-CR-189050 ..... p 1827 N92-20954 * #
NASA-CR-189051 ..... p 1825 N92-20410 * #
NASA-CR-189070 ..... p 1768 N92-20521 * #
NASA-CR-189074 ..... p 1785 N92-20644 * #
NASA-CR-189079 ..... p 1826 N92-20678 * #
NASA-CR-189083 ..... p 1769 N92-20838 * #
NASA-CR-189084 ..... p 1770 N92-20894 * #
NASA-CR-189085 ..... p 1770 N92-20880 * #
NASA-CR-189091 ..... p 1826 N92-20584 * #
NASA-CR-189092 ..... p 1827 N92-20839 * #
NASA-CR-189125 ..... p 1820 N92-20663 * #
NASA-CR-189129 ..... p 1747 N92-20650 * #
NASA-CR-189130 ..... p 1765 N92-20271 * #
NASA-CR-189132 ..... p 1833 N92-20671 * #
NASA-CR-189543 ..... p 1739 N92-20283 * #
NASA-CR-189552 ..... p 1825 N92-20277 * #
NASA-CR-189555 ..... p 1748 N92-20376 * #
NASA-CR-189575 ..... p 1870 N92-20662 * #
NASA-CR-189583 ..... p 1823 N92-20072 * #
NASA-CR-189611 ..... p 1809 N92-20514 * #
NASA-CR-189772 ..... p 1904 N92-20146 * #
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NASA-CR-189914 ..... p 1857 N92-20374 * #
NASA-CR-189925 ..... p 1855 N92-20061 * #
NASA-CR-189932 ..... p 1793 N92-20197 * #
NASA-CR-189937 ..... p 1858 N92-20564 * #
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NASA-CR-189942 ..... p 1858 N92-20549 * #
NASA-CR-189944 ..... p 1795 N92-20563 * #
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NASA-CR-189969 ..... p 1857 N92-20362 *
NASA-CR-189970 ..... p 1749 N92-20528 * #
NASA-CR-189974 ..... p 1745 N92-20664 * #
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NASA-CR-189985 ..... p 1852 N92-20430 * #
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NASA-CR-190072 ..... p 1903 N92-20069 * #
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NASA-CR-190103 ..... p 1796 N92-20673 * #
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NASA-CR-190113 ..... p 1771 N92-20075 * #
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NASA-CR-190121 ..... p 1897 N92-20487 * #
NASA-CR-190122 ..... p 1909 N92-20490 * #
NASA-CR-190128 ..... p 1814 N92-20282 * #
NASA-CR-190130 ..... p 1744 N92-20280 * #
NASA-CR-190131 ..... p 1870 N92-20517 * #
NASA-CR-190137 ..... p 1762 N92-20537 * #
NASA-CR-190140 ..... p 1764 N92-20822 * #
NASA-CR-190142 ..... p 1910 N92-20535 * #
NASA-CR-190149 ..... p 1805 N92-20120 * #
NASA-CR-190151 ..... p 1750 N92-20917 * #
NASA-CR-190156 ..... p 1912 N92-20916 * #
NASA-CR-190163 ..... p 1773 N92-20524 * #
NASA-CR-190165 ..... p 1840 N92-20526 * #
NASA-CR-4424 ..... p 1824 N92-20194 * #
NASA-CR-4430 ..... p 1746 N92-20196 * #
NASA-CR-4432 ..... p 1741 N92-20674 * #

NASA-RP-1273 ..... p 1777 N92-20063 * #
NASA-RP-1274 ..... p 1794 N92-20404 * #

NASA-TM-102554 ..... p 1741 N92-20934 * #
NASA-TM-102873 ..... p 1852 N92-20353 * #
NASA-TM-103569 ..... p 1800 N92-20371 * #
NASA-TM-103574 ..... p 1845 N92-20411 * #
NASA-TM-103827 ..... p 1763 N92-20955 * #
NASA-TM-103904 ..... p 1849 N92-20276 * #
NASA-TM-104179 ..... p 1750 N92-20925 * #
NASA-TM-104209 ..... p 1810 N92-20669 * #
NASA-TM-104215 ..... p 1740 N92-20480 * #
NASA-TM-104225 ..... p 1768 N92-20482 * #
NASA-TM-104226 ..... p 1744 N92-20417 * #
NASA-TM-105101 ..... p 1899 N92-20150 * #
NASA-TM-105249 ..... p 1765 N92-20522 * #
NASA-TM-105288 ..... p 1747 N92-20525 * #
NASA-TM-105311 ..... p 1766 N92-20585 * #
NASA-TM-105345 ..... p 1824 N92-20212 * #
NASA-TM-105355 ..... p 1785 N92-20660 * #
NASA-TM-105378 ..... p 1765 N92-20065 * #
NASA-TM-105413 ..... p 1784 N92-20380 * #
NASA-TM-105539 ..... p 1763 N92-20068 * #
NASA-TM-105547 ..... p 1765 N92-20355 * #
NASA-TM-105556 ..... p 1821 N92-20815 * #
NASA-TM-105564 ..... p 1770 N92-20841 * #
NASA-TM-105579 ..... p 1748 N92-20586 * #
NASA-TM-105581 ..... p 1806 N92-20235 * #
NASA-TM-105590 ..... p 1893 N92-20519 * #
NASA-TM-105591 ..... p 1833 N92-20493 * #
NASA-TM-105619 ..... p 1810 N92-20520 * #
NASA-TM-105627 ..... p 1746 N92-20523 * #
NASA-TM-107767 ..... p 1901 N92-20516 * #
NASA-TM-107778 ..... p 1749 N92-20532 * #
NASA-TM-107779 ..... p 1750 N92-20533 * #
NASA-TM-107793 ..... p 1762 N92-20676 * #
NASA-TM-107798 ..... p 1763 N92-20993 * #
NASA-TM-107804 ..... p 1806 N92-20242 * #
NASA-TM-4278 ..... p 1741 N92-20654 * #
NASA-TM-4342 ..... p 1911 N92-20538 * #
NASA-TM-4343 ..... p 1911 N92-20518 * #
NASA-TM-4348 ..... p 1790 N92-20234 * #

NASA-TP-POD-2 ..... p 1762 N92-20676 * #

NASA-TP-3132 ..... p 1740 N92-20494 * #
NASA-TP-3136 ..... p 1747 N92-20195 * #
NASA-TP-3157 ..... p 1810 N92-20677 * #
NASA-TP-3165 ..... p 1879 N92-20479 * #
NASA-TP-3169 ..... p 1741 N92-20545 * #
NASA-TP-3173 ..... p 1769 N92-20679 * #
NASA-TP-3177 ..... p 1766 N92-20949 * #
NASA-TP-3179 ..... p 1771 N92-20950 * #
NASA-TP-3183 ..... p 1746 N92-20546 * #
NASA-TP-3215 ..... p 1801 N92-20492 * #

NCAR/TN-363+PROC ..... p 1843 N92-20643 #
NCAR/TN-364+STR ..... p 1846 N92-20656 #

NCS-TIB-90-17 ..... p 1866 N92-20869 #
NCS-TIB-90-19 ..... p 1792 N92-20077 #
NCS-TIB-91-2 ..... p 1798 N92-20980 #

NEAR-TR-435 ..... p 1741 N92-20674 * #

NIIEFA-P-K-0859 ..... p 1817 N92-20433 #

NIST/HB-130 ..... p 1790 N92-20252 #
NIST/HB-44 ..... p 1790 N92-20313 #

NIST/MONO-176 ..... p 1794 N92-20427 #

NIST/SP-330 ..... p 1877 N92-20312 #
NIST/SP-50/196 ..... p 1900 N92-20489 #
NIST/SP-500/190 ..... p 1865 N92-20642 #
NIST/SP-811 ..... p 1792 N92-20646 #
NIST/SP-814 ..... p 1791 N92-20450 #
NIST/SP-816 ..... p 1791 N92-20315 #
NIST/SP-818 ..... p 1901 N92-20652 #
NIST/SP-819 ..... p 1814 N92-20651 #
NIST/SP-820 ..... p 1826 N92-20645 #
NIST/SP-826 ..... p 1801 N92-20449 #

NIST/TN-1287 ..... p 1892 N92-20251 * #

NISTIR-3969 ..... p 1790 N92-20107 #
NISTIR-3975 ..... p 1877 N92-20316 #
NISTIR-3980 ..... p 1800 N92-20447 #
NISTIR-4569 ..... p 1886 N92-20394 #
NISTIR-4649 ..... p 1792 N92-20814 #
NISTIR-4660 ..... p 1779 N92-20209 #
NISTIR-4664 ..... p 1785 N92-20657 #
NISTIR-4666 ..... p 1813 N92-20208 #
NISTIR-4679 ..... p 1806 N92-20289 #
NISTIR-4688 ..... p 1749 N92-20448 #
NISTIR-4694 ..... p 1784 N92-20306 #
NISTIR-89/3916-REV ..... p 1856 N92-20328 #

NLR-TP-89365-U ..... p 1740 N92-20473 #
NLR-TP-90029-U ..... p 1741 N92-20498 #
NLR-TP-90035-U ..... p 1872 N92-20499 #
NLR-TP-90082-U ..... p 1858 N92-20474 #
NLR-TP-90087-U ..... p 1748 N92-20475 #
NLR-TP-90093-U ..... p 1830 N92-20426 #
NLR-TP-90112-U ..... p 1827 N92-20800 #

NOAA-DR-ERL-PMEL-35 ..... p 1848 N92-20262 #

NOAA-TM-ERL-ARL-190 ..... p 1742 N92-20318 #

NOAA-TM-ERL-WPL-205 ..... p 1809 N92-20454 #
NOAA-TM-ERL-WPL-209 ..... p 1847 N92-20257 #
NOAA-TM-ERL-WPL-212 ..... p 1844 N92-20263 #

NOAA-TM-NWS-NSSFC-31 ..... p 1844 N92-20264 #

NOAA-TM-NWS-SR-139 ..... p 1844 N92-20261 #

NOSC-TR-1462 ..... p 1888 N92-20963 #
NOSC-TR-1469 ..... p 1798 N92-20981 #

NRC-LTR-ST-1689 ..... p 1787 N92-21018 #

NRC-32124 ..... p 1742 N92-20156 #

NREL/TP-214-4453 ..... p 1894 N92-20701 #
NREL/TP-214-4588 ..... p 1831 N92-20054 #
NREL/TP-214-4589 ..... p 1890 N92-20055 #
NREL/TP-214-4606 ..... p 1833 N92-20648 #
NREL/TP-250-4602 ..... p 1831 N92-20051 #
NREL/TP-253-4493 ..... p 1911 N92-20050 #
NREL/TP-254-4515 ..... p 1805 N92-20052 #
NREL/TP-254-4593 ..... p 1831 N92-20053 #
NREL/TP-254-4601 ..... p 1790 N92-20049 #
NREL/TP-257-4625 ..... p 1834 N92-21034 #
NREL/TP-257-4654 ..... p 1833 N92-20245 #

NRL-MR-6930 ..... p 1889 N92-20892 #

NSF-ITP-92-05 ..... p 1897 N92-20487 * #

NSF/ISI-91006 ..... p 1772 N92-20305 #

NTIA-91-279 ..... p 1794 N92-20336 #

OEFZS-4571 ..... p 1809 N92-20511 #
OEFZS-4575 ..... p 1885 N92-20162 #

ONERA-NT-1991-5 ..... p 1909 N92-20477 #

ONERA-RSF-128/1865-AY-726A p 1748 N92-20385 #

ONERA-RT-110/3454-RY-102-R . p 1825 N92-20390 #
ONERA-RT-16/3641-PY ..... p 1878 N92-20387 #
ONERA-RT-3/3801-PY ..... p 1785 N92-20386 #
ONERA-RT-96/5094-PY ..... p 1878 N92-20388 #

ORNL/ATD-61 ..... p 1895 N92-20969 #

ORNL/M-1157 ..... p 1840 N92-20543 #
ORNL/M-1745 ..... p 1783 N92-20098 #

OTA-BA-463 ..... p 1850 N92-21009 #
OTA-BA-494 ..... p 1848 N92-20215 #

OUTP-91-24P ..... p 1881 N92-20246 #

P/W-FR21998-2 ..... p 1782 N92-21015 #

PATENTS-US-A7531363 ..... p 1787 N92-21065 #
PATENTS-US-A7535007 ..... p 1787 N92-21066 #
PATENTS-US-A7539392 ..... p 1896 N92-21067 #

PB91-182584 ..... p 1828 N92-20798 * #
PB91-193383 ..... p 1801 N92-20640 #
PB91-216705 ..... p 1914 N92-20790 #
PB91-228817 ..... p 1835 N92-20108 #
PB91-240267 ..... p 1840 N92-20540 #
PB91-241331 ..... p 1809 N92-20454 #
PB91-241414 ..... p 1911 N92-20536 #
PB91-241422 ..... p 1912 N92-20539 #
PB91-243105 ..... p 1774 N92-20641 #
PB92-101427 ..... p 1793 N92-20223 #
PB92-101500 ..... p 1819 N92-20222 #
PB92-101567 ..... p 1839 N92-20466 #
PB92-105436 ..... p 1843 N92-20643 #
PB92-106384 ..... p 1901 N92-20542 #
PB92-107002 ..... p 1828 N92-20321 #
PB92-107580 ..... p 1844 N92-20261 #
PB92-108885 ..... p 1813 N92-20208 #
PB92-108901 ..... p 1779 N92-20209 #
PB92-109008 ..... p 1892 N92-20251 * #
PB92-109016 ..... p 1901 N92-20652 #
PB92-109024 ..... p 1814 N92-20651 #
PB92-109032 ..... p 1877 N92-20312 #
PB92-109040 ..... p 1865 N92-20642 #
PB92-109107 ..... p 1838 N92-20439 #
PB92-109115 ..... p 1836 N92-20207 #
PB92-109230 ..... p 1853 N92-20221 #
PB92-110261 ..... p 1901 N92-20816 #
PB92-110378 ..... p 1838 N92-20441 #
PB92-111632 ..... p 1850 N92-21008 #
PB92-111830 ..... p 1838 N92-20444 #
PB92-111905 ..... p 1839 N92-20445 #
PB92-111913 ..... p 1839 N92-20446 #
PB92-112051 ..... p 1836 N92-20224 #
PB92-112291 ..... p 1806 N92-20289 #
PB92-112333 ..... p 1800 N92-20447 #
PB92-112358 ..... p 1877 N92-20316 #
PB92-112366 ..... p 1790 N92-20107 #
PB92-112416 ..... p 1790 N92-20252 #
PB92-112424 ..... p 1790 N92-20313 #
PB92-112465 ..... p 1791 N92-20315 #
PB92-112473 ..... p 1792 N92-20814 #
PB92-112564 ..... p 1886 N92-20394 #
PB92-112580 ..... p 1749 N92-20448 #
PB92-113463 ..... p 1836 N92-20225 #
PB92-113851 ..... p 1844 N92-20325 #
PB92-114123 ..... p 1877 N92-20274 #
PB92-114149 ..... p 1903 N92-20389 #
PB92-114156 ..... p 1903 N92-20700 #
PB92-114255 ..... p 1800 N92-20287 #
PB92-114495 ..... p 1839 N92-20478 #
PB92-114503 ..... p 1841 N92-20817 #
PB92-114529 ..... p 1839 N92-20483 #
PB92-114586 ..... p 1742 N92-20318 #
PB92-114610 ..... p 1903 N92-20319 #
PB92-114636 ..... p 1839 N92-20476 #
PB92-114719 ..... p 1900 N92-20456 #
PB92-114727 ..... p 1858 N92-20457 #
PB92-114735 ..... p 1743 N92-20818 #
PB92-115062 ..... p 1846 N92-20655 #
PB92-115443 ..... p 1856 N92-20253 #
PB92-115633 ..... p 1872 N92-20278 #
PB92-115823 ..... p 1848 N92-20215 #
PB92-115955 ..... p 1845 N92-20326 #
PB92-116060 ..... p 1839 N92-20481 #
PB92-116383 ..... p 1792 N92-20646 #
PB92-116425 ..... p 1826 N92-20645 #
PB92-117589 ..... p 1850 N92-21009 #
PB92-118009 ..... p 1819 N92-20254 #
PB92-118017 ..... p 1836 N92-20255 #
PB92-118819 ..... p 1847 N92-20257 #
PB92-118983 ..... p 1772 N92-20331 #
PB92-119080 ..... p 1912 N92-20544 #
PB92-119098 ..... p 1912 N92-20823 #
PB92-119627 ..... p 1846 N92-20656 #
PB92-119643 ..... p 1901 N92-20821 #
PB92-119817 ..... p 1848 N92-20262 #
PB92-120047 ..... p 1820 N92-20339 #
PB92-120237 ..... p 1900 N92-20304 #
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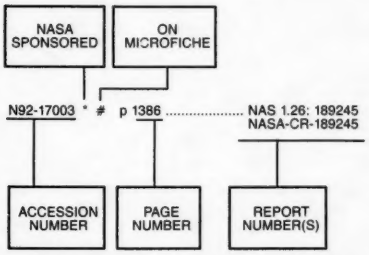

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